F·A·A·M facility for airborne atmospheric measurements

FLIGHT FOLDER

Flight No. **B423**
Date: 20 Jan 2009
Take Off: 12:00:47
Landing: 17:22:42
Flight Time: 5h 21m 55s

Campaign: APPRAISE CLOUD Flight
Operating Area: Over and to the west of the Chilbolton radar facility. Area Alpha.

POB	Position	Name	Institute	Logs y/n
1	Captain	Al Roberts	Directflight	
2	Co-pilot	Ian Ramsay-Rae	Directflight	
3	CCM	Gaynor Ottaway	Directflight	
4	Mission Scientist 1	Keith Bower	Manchester University	
5	Mission Scientist 2	Jonny Crosier	Manchester University	
6	Flight Manager	Mo Smith	FAAM	
7	CCN / Chemistry / Flight Manager training	Jamie Trembath	FAAM	
8	Cloud Physics	Phil Rosenberg	FAAM	
9	CVI / Filters	James Bowles	Met Office	
10	AMS	Paul Williams	Manchester University	
11	Manc. Cloud	James Dorsey	Manchester University	
12				
13	*Crew details taken from FAAM website -*	*not from Flight*	*Manager in flight*	
14				
15				
16				
17				
18				

The following log sheets are not available for this flight :

Log	Reason
Pre-flighter log	No log available
Flight Manager's Faults/Incidents log	No log in network drive
Track plot	No GPS track plot was created automatically
Cloud Physics In Flight	Awaiting confirmation of whether a log was created
Cloud Physics Processing	Awaiting confirmation of whether a log was created
Core Chemistry / TDLAS	No In Flight log except in cases of instrument problems
PSAP log	No log as PSAP pump / filter info included on Flight Summary page
Filters	Awaiting confirmation of whether a log was created
CVI	Awaiting confirmation of whether a log was created
Manc. Cloud	Manc. Cloud operator does not create a log sheet
AMS log	AMS operator does not create a log sheet
CCN	CCN operator does not create a log sheet

Document control

Revision	Date	Author	Comments
r0	29 Dec 2009	Doug Anderson	Initial version missing the above noted logs
r1			

No Digital8 video recordings were made on this flight.

Digital video recordings in avi format:

faam-video-dfc_faam_20090120_r0_b423_122939_1hz.avi
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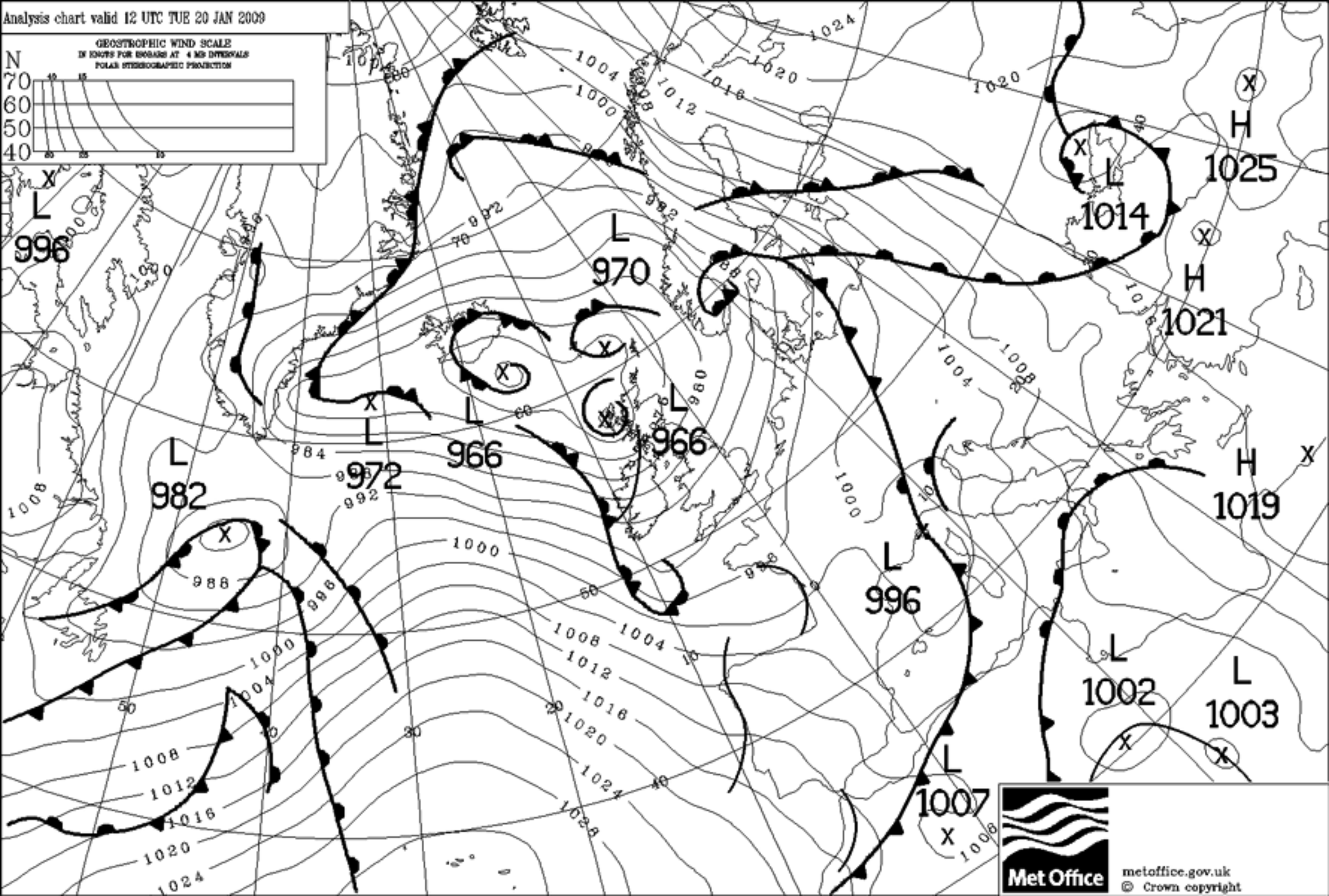
FLIGHT SUMMARY

Flight No B423
Date:
Project:
Location:

Start Time	End Time	Event	Height (s)	Hdg	Comments
114721		Start-Up	1.00 kft	126	
114826		taxy	1.00 kft	126	
114910		ASP	0.99 kft	053	Open
120047		T/O	0.00 kft	213	
122923		Video	18.0 kft	250	starteded
124001		PSAP	18.0 kft	251	Off
124029		PSAP	18.0 kft	251	On
124726		PSAP	18.0 kft	249	Off
124928		psap	18.0 kft	250	On
124721	125310	Run 1	18.0 kft	250	
125310	125442	Profile 1	18.0 - 17.0 kft	250	
125443	130225	Run 2	17.0 - 16.9 kft	098	
125807		PSAP	17.0 kft	069	Off
130143		PSAP	17.0 kft	073	On
130226	130319	Profile 2	16.9 - 16.0 kft	111	
130319	131000	Run 3	16.0 kft	131	
130732		PSAP	16.0 kft	252	Off
130926		PSAP	16.0 kft	247	On
131000	131233	Profile 3	16.0 - 14.0 kft	219	
131234	131726	Run 4	14.0 kft	025	
131421		PSAP	14.0 kft	061	Off
131627		PSAP	14.0 kft	059	On
131726	131931	Profile 4	14.0 - 12.0 kft	135	
131932	132406	Run 5	12.0 - 11.9 kft	329	
132203		PSAP	12.0 kft	249	Off
132327		PSAP	12.0 kft	241	On
132407	132632	Profile 5	11.9 - 10.0 kft	203	
132632	133026	Run	10.0 kft	066	
132815		PSAP	10.0 kft	060	Off
132903		PSAP	10.0 kft	105	On
133026	133928	Profile 6	10.0 - 1.7 kft	218	
133519		PSAP	5.4 kft	217	Off
133657		PSAP	3.8 kft	212	On
133929	134611	Run 7	1.7 kft	210	
134449		PSAP	1.6 kft	032	Off
134459		PSAP	1.7 kft	031	On
134611	134732	Profile 7	1.7 - 2.7 kft	032	
134733	135446	Run 8	2.7 kft	081	
135207		PSAP	2.6 kft	217	Off
135230		PSAP	2.6 kft	216	On
135334		Nevzorov	2.6 kft	216	Total Water off
135447	135652	Profile 8	2.7 - 4.6 kft	215	
135653	140010	Run 9	4.6 - 4.7 kft	051	
135818		PSAP	4.6 kft	057	Off
140003		PSAP	4.6 kft	055	On
140010	140129	Profile 9	4.7 - 5.7 kft	056	
140129	140657	Run 10	5.7 kft	066	
140359		PSAP	5.7 kft	227	Off
140552		PSAP	5.6 kft	238	On
140657	140757	Profile 10	5.7 - 6.6 kft	236	
140757	141419	Run 11	6.6 - 6.7 kft	289	
141120		PSAP	6.6 kft	069	Off
141359		PSAP	6.6 kft	068	On
141420	141549	Profile 11	6.7 - 7.7 kft	063	
141550	141853	Run 12	7.7 kft	260	
141802		PSAP	7.6 kft	211	Off
141846		PSAP	7.6 kft	210	On
141854	141953	Profile 12	7.8 - 8.7 kft	210	
141953	142408	Run 13	8.7 kft	252	
142233		PSAP	8.7 kft	060	Off

142330		PSAP	8.7 kft	060	On	
142409	142617	Profile 13	8.7 - 10.7 kft	060		
142617	142940	Run 14	10.7 - 10.6 kft	253		
142822		PSAP	10.7 kft	208	Off	
142930		PSAP	10.6 kft	207	On	
142941	143129	Profile 14	10.6 - 11.7 kft	207		
143130	143349	Run 15	11.7 - 11.6 kft	033		
143245		PSAP	11.6 kft	070	Off	
143336		PSAP	11.6 kft	071	On	
143606	144636	Profile 15	11.3 - 5.5 kft	117		
144057	150728	Run 16	5.5 kft	071		
150729	152112	Profile 16	5.5 - 20.0 kft	249		
152112	153737	Run 17	20.0 kft	250		
160137	160817	Profile 17	19.7 - 12.4 kft	288	interupt	
161042	161224	Profile 17	12.5 - 11.3 kft	116	restart interupt	
161340	161509	Profile 17	11.5 - 10.4 kft	255	restart interupt	
161829	162114	Profile 17	10.0 - 8.0 kft	056	restart interupt	
162440	162751	Profile 17	8.0 - 5.3 kft	233	restart intrerupt	
162955	163713	Run	5.0 - 5.1 kft	241	run 18	
163713	164601	Profile 18	5.1 - 14.0 kft	065	run 18	
172242		Land	0.90 kft	211		
172725		Shutdown	0.91 kft	305	52'04.36N	0'37.50W


Analysis chart valid 12 UTC TUE 20 JAN 2009
GEOSTROPHIC WIND SCALE
IN KNOTS FOR 850MB AT 4 MB INTERVALS
POLAR STEREOGRAPHIC PROJECTION
N
70
60
50
40
L 996
L 982
L 972
L 966
L 970
L 966
L 996
L 1014
H 1025
H 1021
H 1019
L 1002
L 1003
L 1007
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Pilot: Luc Lathouwers
NavData Cycle 2009-1 Expires: Thursday, 12 February 2009.
Scale: 1:1066183 (1 inch = 14.62 naut mi). Printed on 19 Jan 2009

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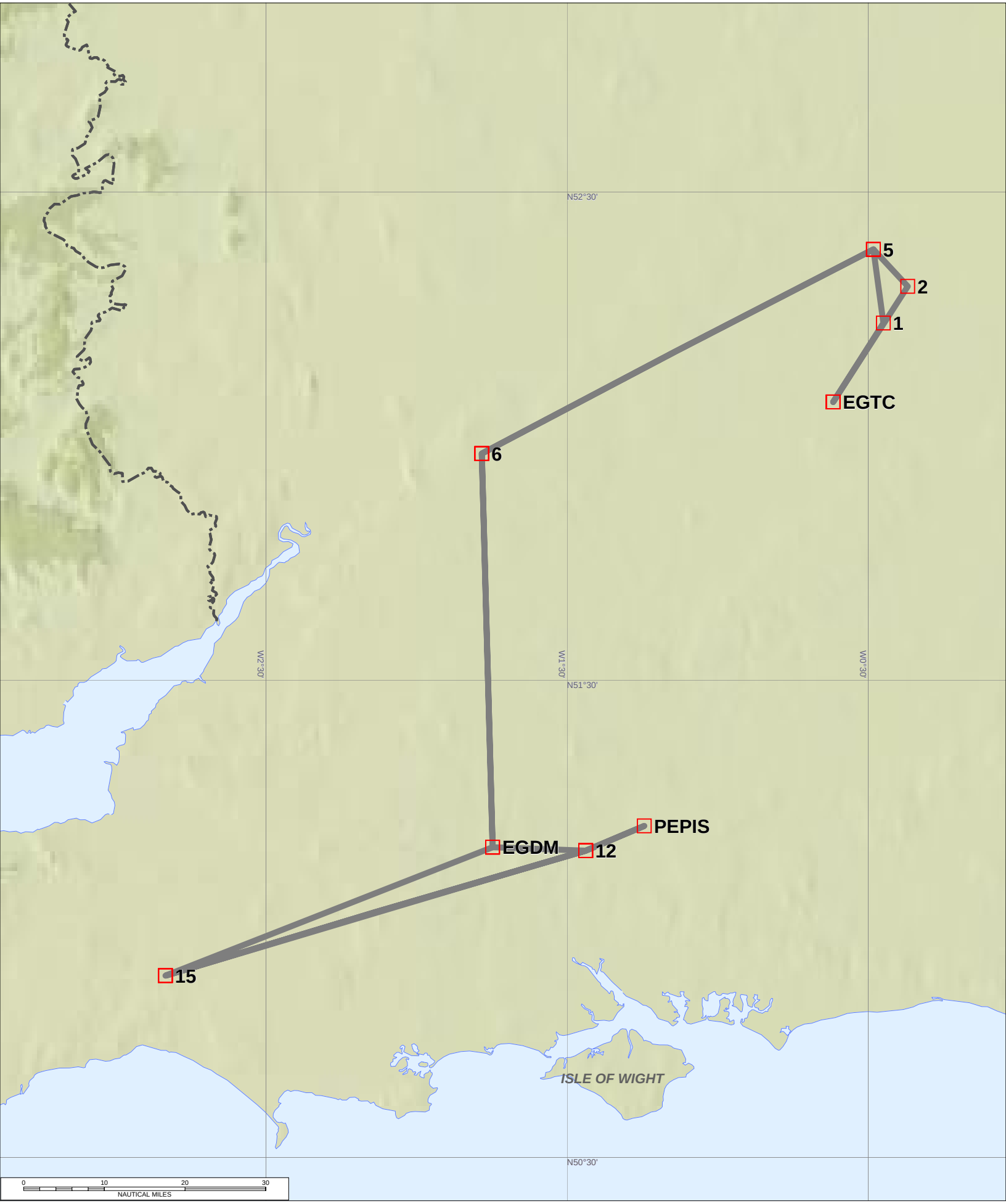
FliteStar 9.4.3.0



Sortie Brief: APPRAISE-Clouds: mixed-phase cloud studies
Date: 20 Jan 2009
Flight Number: B423
Earliest T/O time: 12.00z
M.Sci: Keith Bower

Sortie Aims: To measure ice and liquid-phase microphysical processes in frontal and other clouds in association with the Chilbolton radar facility.

Sortie Location: Over and to the west of the Chilbolton radar facility. Area Alpha**.**

Sortie Summary: Perform a series of runs at a series of altitudes below cloud base (if possible), within and above the cloud, along the azimuth that is being scanned by the radar. Information on the run orientation and altitude to be flown will be provided by scientists at Chilbolton using VHF radio (call-sign "Radsearch"). Where the radar identifies a small-scale feature of interest, the aircraft may abort a long leg in order to turn to re-penetrate it. Where either the aircraft or radar identifies a particular horizontal layer of interest, the aircraft may fly a sawtooth pattern so as to provide a sequence of profiles through it. It is desired that the aircraft flight legs start/finish in the Chilbolton overhead. This benefits the validation of vertically-pointing radar/lidar retrievals of supercooled cloud layers. This requires turns to be done within controlled airspace and so may limit the number of occasions that this is possible.

Sortie Detail:

a) T+0 Take off & climb to FL100 to transit to operating area at Chilbolton.
b) T+35 When at suitable location descend from transit altitude to 1000ft agl, or to lowest altitude allowed by operating restrictions (may only be achieved with approach to Boscombe Down airfield – but may be omitted depending on conditions). Fly leg in **clear air** for 10 min.
c) Perform a profile ascent at 1000ft/min along the azimuth and through the cloud system up to FL330 or to above mid level cloud top, whichever is lower.
d) Fly a series of 40-60km level flight legs along the azimuth scanned by the radar at altitudes defined by the radar or as determined from previous profile. Ideally, just above cloud base, throughout the cloud, just below and just above cloud top. Duration of each leg ~10 minutes. Legs should extend over Chilbolton. During incloud legs AMS should sample off CVI inlet unless tip iced up (but sample off Rosemount inlet out of cloud). Filters to be exposed on out of cloud legs only.
e) Where the radar identifies a feature of interest or one that is penetrated by the aircraft along any profile or leg, the profile/leg may be interrupted to fly one or more butterfly patterns. Each butterfly consists of a minimum of two minutes straight/level that includes penetration of the feature followed by turns that allow re-penetration of the feature during the reciprocal part of the pattern.
f) Where a defined layer of interest (such as a shallow layer of supercooled liquid water) is identified by the aircraft or radar, the long leg may be flown as a sawtooth leg with ascents/descents at 1000ft/min, extending 1000ft above and below the layer level (M.Sci may request level segments of 1 minute).
g) Repeat items d) to e) as long as flight endurance or cloud conditions permit.
h) End with below-cloud clear air aerosol leg (10 min), before recovering to Cranfield.

PROJECT BRIEF: APPRAISE-Clouds – mixed-phase cloud studies

Scientific Aims: The purpose of this project is to obtain detailed microphysical measurements in stratiform cloud systems, altocumulus clouds, wave clouds and cumulus clouds within the temperature regime in which ice particles will likely co-exist with liquid (typically 0 to -30C).

The flight plans are designed to characterise the aerosol above and below the cloud and infer aerosol fluxes into the cloud layer by combination with the vertical wind measurements and the microphysical characteristics within the cloud layer.

Constant altitude flight legs of approximately 50 km (10 minutes flying) will be made:

• In the boundary layer to measure the aerosol size distributions (from 10 nm to 100 um), CCN, aerosol composition from 30 nm to 1 um using the ToF AMS; larger particles and non-volatile material such as refractory material will be measured using EDAX analysis of filter samples.

• Near cloud base within cloud to measure the cloud droplets that have been activated from CCN, interstitial particles and larger particles that have fallen from cloud top. In addition the onset of ice will be observed using the CPI, CAPS and 2-D probes in cloud.

• Middle of the cloud passes will be made at temperatures where key processes will be expected to be initiated (-6C to -9C) for the Hallett-Mossop process or around -15C where fragmentation of dendritic crystals may be important.

• Near cloud top and within the cloud to measure entrainment and aerosols within entrained eddies and ice particles within the cloud; in colder clouds ice initiation will occur in this region.

• Above the cloud to measure the properties of aerosol particles that can potentially be entrained into the clouds.

In-situ measurements from the aircraft are performed in close coordination with the CAMRa radar and lidar facilities at Chilbolton, Hants.

Weather conditions: Stratiform, or altocumulus clouds lying over and to the west of the Chilbolton radar facility. This may or may not be generating precipitation at the surface. It is particularly desirable if the mean wind direction lies between about 220 and 280 degrees. This allows the aircraft to fly legs along the radar beam whilst staying closely parallel to the mean wind direction.

Key instruments and their operation.

Basic meteorology

- Rosemount temperatures, GE hygrometer, CR2
- GPS, INU, turbulence probe – When in supercooled liquid water, Flight Manager or PIs should monitor turbulence probe calibrated differential pressures for signs of icing (cessation of variability on signal).

Cloud/Aerosol Physics/Chemistry

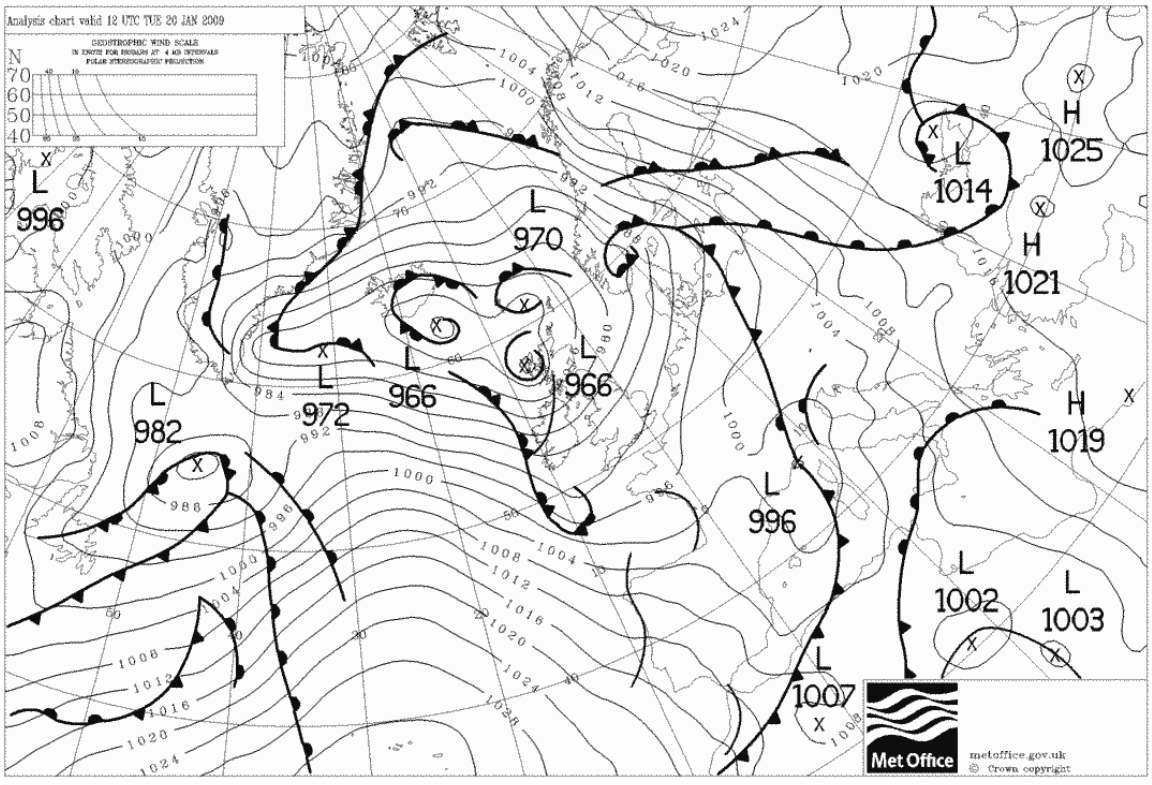
- FFSSP, 2DC, 2DP, PCASP, CDP. Normal monitoring to ensure correct operation. Operator should note particular features of interest eg. high concentrations, appearance of pristine ice crystal habits, appearance of large drops (>100micron) in 2D imagery when above freezing level.
- CPI and 2DS, CAPS and FSSP – as above
- J-W LWC and Nevzorov LWC/TWC. Where a run is only partially in cloud and is starting in clear air, these should be zeroed/calibrated and a note made in the Flight Manager's log.
- TWC. If possible, a profile in clear air is desirable for calibration purposes.
- AMS, SMPS/WCPC (- to sample off both Rosemount and CVI inlets)
- Filters

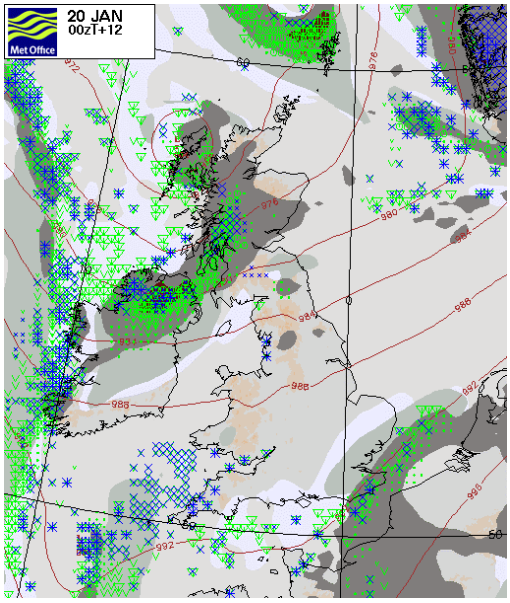
CVI inlet sampling: residuals (and Lyα) incloud; aerosols out of cloud (PCASP, CPC)

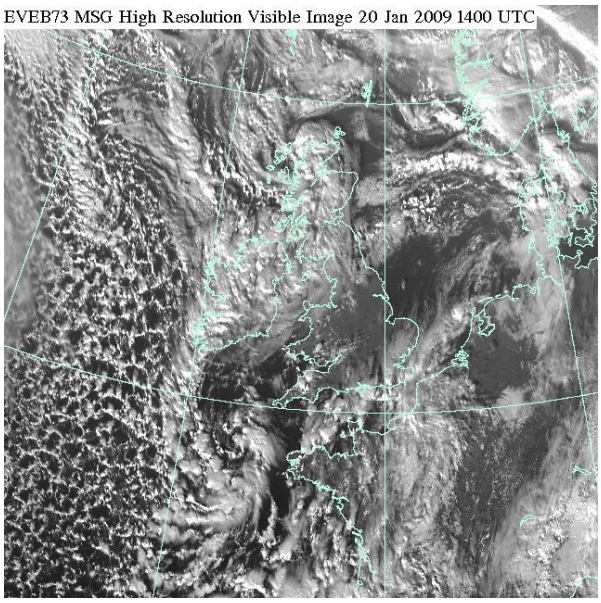
Mission Scientist Debrief: APPRAISE-Clouds: mixed-phase cloud studies:
Flight Number: B423, 20th Jan 2009 (T/O Cranfield 12:00; Landing Cranfield 17:22)
Mission Scientist: Keith Bower

Sortie Aims: To measure ice and liquid-phase microphysical processes in frontal and other clouds in association with the Chilbolton radar facility.

Weather conditions & operating area: On this day the UK lay between frontal systems that had passed across the country on the previous day and those that would cross the country the next day (and be sampled on the next flight). An area of low pressure lay in the N. Atlantic to the NW of the British Isles (and over Iceland), and an occluded front was approaching the British Isles from the west. At midday this front was still to the west of Ireland. A number of troughs were forecasted to cross the country during the day, generating convection and a number of isolated showers. In particular a number of such cells were predicted for the SW of England and out over the Bristol channel and SW approaches (see Met Office mesoscale cloud model forecast for midday below), so on this occasion the plan was to sample some of these mixed phase turrets as they developed over the Bristol Channel and SW whilst keeping an eye out for any such activity over Chilbolton and on the (255°) radial to the west. Take off time was set at 12 noon so as to maximise the likelihood of convective activity.







MetOffice mesoscale model forecast for 12:00z (left) and High Resolution Visible satellite image (right) for the UK at 14:00 on January 20th 2009

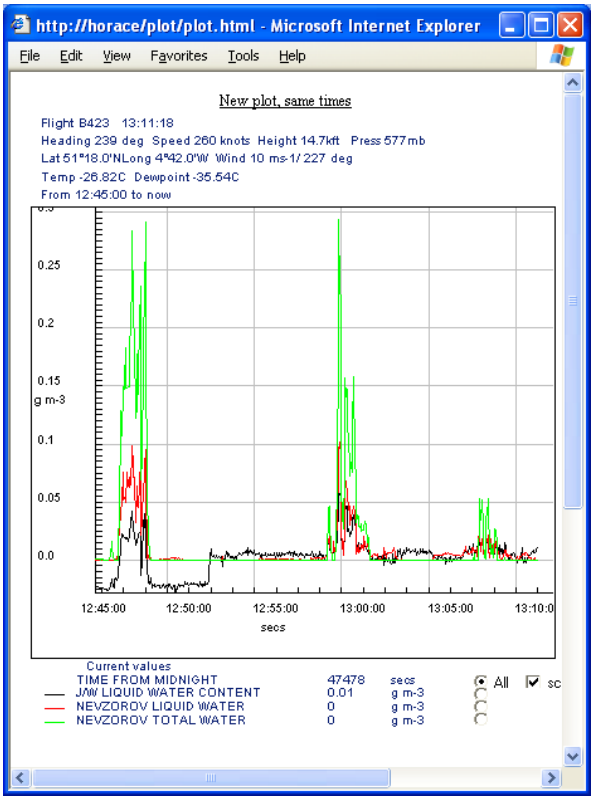
Summary of the flight: Take off was at 12:00. In the absence of significant cloud activity in the Chilbolton area at this time it was decided to transit straight out via Brecon to the Bristol channel and SW region, where the convection and shower activity was predicted to be high. The transit was initially at FL100 (696mbar, -14°C) and then at FL180 (505mbar, -35.6°C). The climb to FL180 took the aircraft, firstly under, and then through cirrus cloud. Large ice crystals (200µm) of mixed habit were seen by CPI/2DS/CIP to be precipitating out of this cloud. 2DC observed this precipitation (ppt) too but it was not clear whether this was true for 2DP as this instrument was seeing a high degree of noise on the signal. The transit took the aircraft towards the south Wales coast (at the Gower peninsular) where a number of small convective clouds could be seen ahead, to the left and right, with a smaller number of bigger turrets with developing or full anvils. At 12:45 a large mature cloud was observed directly ahead of the aircraft (see photo below left).

Cloud 1(left) investigated off Gower (12:45z) & Cloud 2 (right) investigated over Lundy Island (13:50z)

It was decided to carry out a series of straight and level runs (SLRs) through this turret to investigate the different microphysical properties of the cloud at different distances above cloud base (CB). SLRs R1, R2, R3, R4, R5 and R6 were carried out at flight levels FL180, FL170, FL160, FL140, FL120 and FL100 respectively. Each of these runs was followed by profile descents P1, P2, P3, P4, P5 and P6 respectively.

Table 1 – Cloud Turret 1 (mature) – descending SLRs

Run # P #	Entry time	Exit time	Flight level / Pressure (mbar)	Temp (°C)	Comments/observations
R1 (P1)	12:47:22	12:49:22	FL180 505 mbar	-35.6 -35.6	Extending Run to 4 minutes clear air each side of cloud (inc turn) – then profile
R2 (P2)	12:59:34	13:01:38	FL170 526 mbar	-32.8 -33.1	2DS/2DC seeing ppt out of anvil (before entry) peaking 75µm, up to 200-300µm (2DP not working)
R3 (P3)	13:07:24	13:09:59 (run end)	FL160 549 mbar	-30.2 -30.3	Out of cloud time ~same as end of Run (no clear air section to save time) Aggregates of plates & needles & water??
R4 (P4)	13:14:53	13:16:23	FL140 594 mbar	-13.0 -15.7	Cloud maturing now
R5 (P5)	13:19:29	13:24:04	FL140	-19.9 -19.8	Vertical wind ~>1.5m/s in cloud c.f. outside cloud. Cloud edges less distinct
R6 (P6)	13:26:25	13:30:26	FL150	-15.8 -15.3	Very little cloud left now, AMS, CCN, PCASP seeing zero – cloud dissipated



This mature cloud dissipated at lower levels before it could be investigated fully (see diminishing total/liquid water contents from R1 to R2 to R3 - left). It was therefore decided to fly to the SW (towards waypoint 37) and look for a younger growing turret in which to carry out SLRs through at ascending levels as the cloud was growing. En-route PCASP measured 10cm^{-3} and CAS 2-5cm^{-3} (5.7kft, 818mbar, -7.0°C) in clear air during profile descent P6. A descending pass through a smaller turret was made (entry at 4.8kft, 849mbar, -4.6 °C, exit at 3.7kft, 882mbar, -2.0°C) but the cloud consisted only of liquid water. CCN measured 5-6cm^{-3} (0.2%) and PCASP 10 cm^{-3}. P6 was terminated at 1000ft (1.6kft on 990mbar pressure setting), and a small developing cloud chosen to investigate next, starting with a below cloud pass.

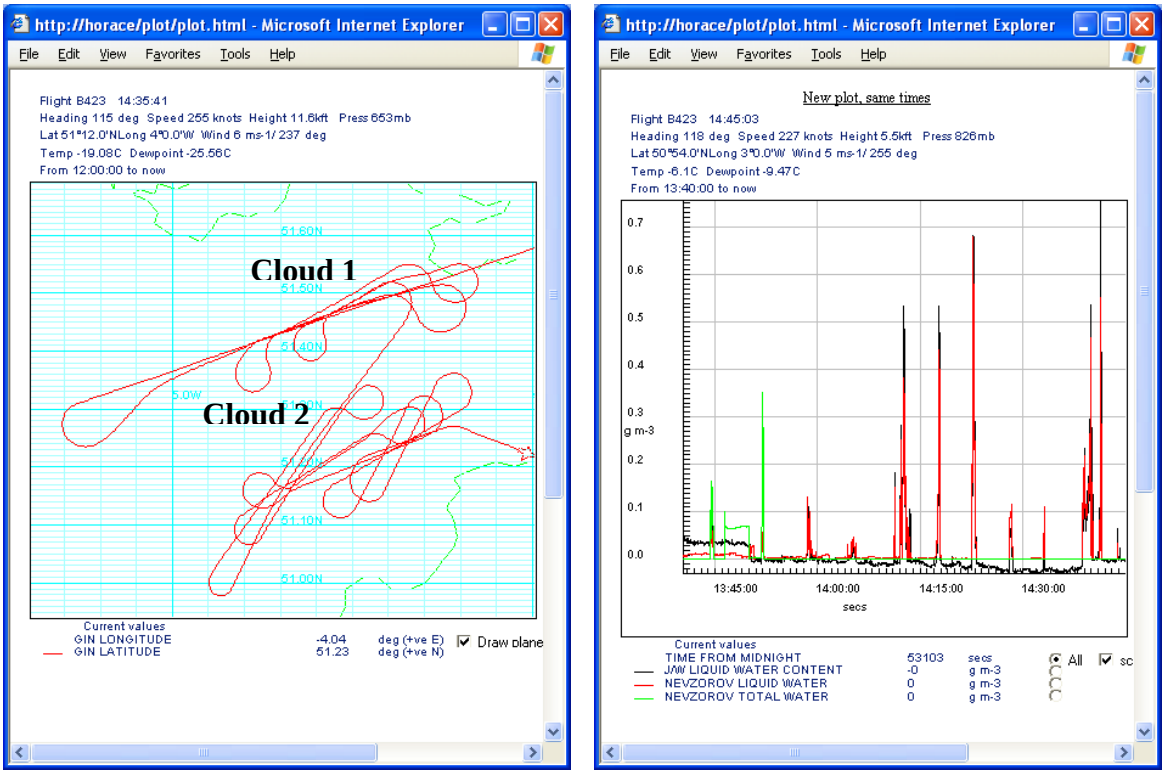
The second cloud investigated in detail is shown in the Photo (right) above. It was precipitating out of the bottom, and seemed to have formed over the top of Lundy Island. Both R7 and R8 were flown under the cloud and through the ppt (at 1000 and 2000ft respectively). The 2DP appeared to wake up and saw the ppt particles. Filters were exposed briefly either side of the ppt shafts which was mainly comprised of rain but did contain ice. In-cloud SLRs R9, R10, R11, R12, R13, R14, and R15 were carried out at sequentially higher levels through this growing turret as summarised below.

Table 2 – Cloud turret 2 (young growing) – ascending SLRs

Run # P # up	Start Time (cloud)	End time (cloud)	Flight level / Pressure (mbar)	Cloud Temp (°C)	Comments/observations
R7 (P7)	13:39:24	13:46:07	1000ft (1.6kft) 953 mbar	+4.0* +4.1*	Below small developing cloud forming over Lundy Island. Cloud is precipiting – 2DP saw ppt
R8 (P8)	13:47:31	13:54:42	2000ft (2.6kft) 919 mbar	+1.4* +1.4*	Still below cloud – filters on now. PCASP 10cm-3 , CAS~8 cm-3 "deformed rain" – melting crystals?? CPI sees ice. * NB Lost Nevzorov total water signal *
R9 (P9)	13:56:03 (13:58:35	14:00:06 (13:59:26	4000ft (4.6kft) 854 mbar	-4.2 -4.0	Incloud temps (0.4° colder than out of cloud) Bumpy before going into cloud. CPI saw mostly water + rimed aggregates
R10 (P10)	14:01:28 (14:04:17	14:06:49 (14:05:44	5000ft 5.6kft 822 mbar	-6.6 -6.8	Incloud Temps (0.4° colder than out of cloud) cloud now mostly ice with a little water
R11 (P12)	14:07:57 (14:12:13	14:14:18 (14:13:20	6000ft 6.6kft 792 mbar	-8.3 -10.0	Flew through a little water cloud before main cloud. Bumpy in main cloud. Very lumpy exiting cloud +heavy ppt same time. Warmer outside cloud again – both sides
R12 (P12)	14:15:49 (14:17:58	14:18:42 (14:13:20	7000ft 7.6kft 763 mbar	-12.2 -11.9	Warmer before cloud again. Mixed phase, ice falling out of anvil now – on each side, but liquid up the middle.
R13 (P13)	14:19:52 (14:22:39	14:24:07 (14:23:16	8000ft 8.6kft 733 mbar	-13.29 -13.82	Cloud edge followed by ppt. Turbulence out of cloud too. NB cloud drifting eastward – hard to tell if same cloud. Pilots "cloud rising faster than us" – increase next profile step
R14 (P14)	14:26:10 (14:28:11	14:29:36 (14:29:00	10,000ft 10.6kft 679 mbar	-17.2 -16.9	Bumpy in cloud again
R15 (P15)	14:31:27 (14:33:11	14:33:50 (14:33:11	11,000ft 11.6kft 653 mbar	-19.1 -19.1	In and out of cloud. Going of to Chilbolton next

Information was received (part way through measuring cloud 2 above) that there was cloud over Chilbolton and that we should return to measure it. However, it was decided to stay with cloud 2 as long as it was growing to investigate the evolution of its

microphysics. After finishing R15 a profile descent was undertaken to pass under the N-S airlanes east of Exeter and to begin an inbound leg to CH along the 255° radial. Cloud was present between 7.9kft (754mbar, -11.7°C) and 6.2kft (808mbar, -8.4°C), within which the aircraft anti-icing system detected the presence of liquid water



(Left) position of Cloud 1 and Cloud 2, and the track of the aircraft in each. Right, the liquid water content of subsequent runs through cloud 2 (without Nevzorov total water)

Run 16 was carried out at FL55 (4500kft, 826mbar, -5.7°C) inbound to Chilbolton (CH) along the 255 radial. The radar reported cirrus at 4-7km (13-23kft); however there was little observable cloud along the radial. Outbound from CH, profile ascent P16 up to FL200 was undertaken to investigate any cirrus cloud that was present. During the ascent, cloud could be seen apparently along the south coast to the left of our track. At FL200 (465mbar, -40.2°C), R17 was initiated just before the SW turn and then inbound to CH. No cloud was encountered until overhead at CH and particularly in the turn to the east at Pepis. It appeared that this was the edge of some Ci cloud which seemed to be advecting eastwards out of our operating area. It was thus decided to return to the Bristol Channel to sample more convective clouds in that area. R17 was continued along the outbound radial to the SW end and again as we turned to head back to the Bristol Channel (at FL200). Ci outflow from an anvil was encountered N of Exeter, and there were some of these cloud systems ahead lining up along the north Devon coast. During the first encounter pristine stellar and column crystals were observed. Ahead of us along the coast (at Ilfracombe), a mature turret with a substantial anvil was present. In the remaining time left it was

decided to profile down through this cloud to examine the microphysics as a function of altitude. The photographs below show the cloud which was to be sampled.

The third major convective cloud investigated during B423. The cloud was mature, and investigated by profiling down through it.

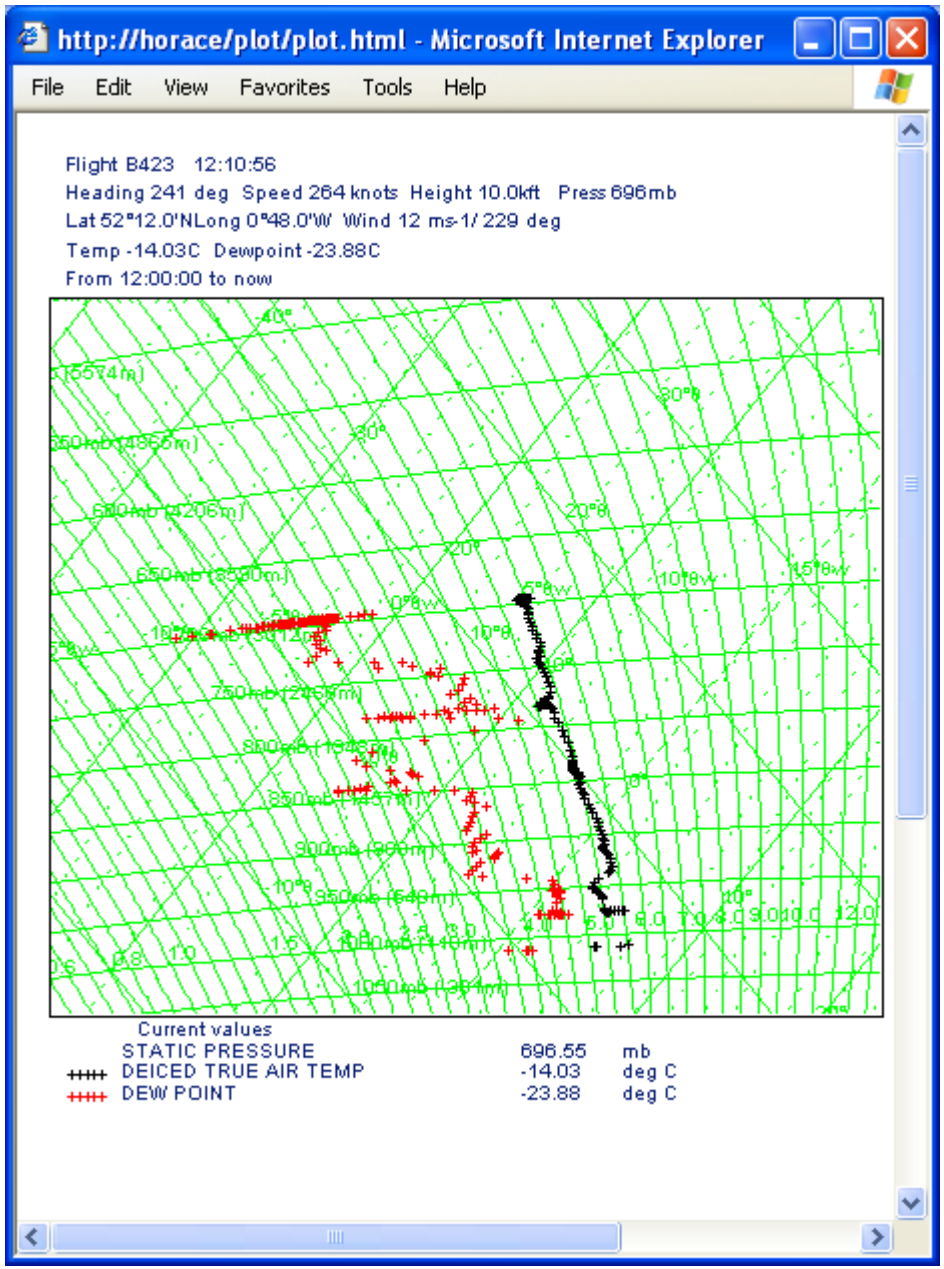
Profile P17 started (on a heading of 300°) from the SE at FL200 and encountered the cloud at 15kft (570mbar, -27.2°C). After passing through the turret P17 was interrupted at 12.5kft (631mbar, -21.7°C) to carry out a turn to head back into the cloud on a reciprocal heading. 2DC reported 1000 Litre^{-1} of particles (more on eastern edge) and a total water content of 10g cm^{-3} was estimated. CPI reported some big ice particles. P17 was interrupted again upon leaving the cloud at 11.4kft (659mb, -19.0°C) and recommenced on a more SW heading (closer to land to avoid the red area on the cloud radarand to take account of cloud movement) at the same altitude. Heavy (solid) precipitation was encountered at the cloud edge (could hear ppt hitting fuselage) before exiting and interrupting the profile at 10.5kft (682mbar, -17.7°C). The profile and cloud penetration was recommenced on the reciprocal (NE) heading. Significant icing was observed to build up on both port and starboard pylons (4mm). The cloud appeared to consist almost totally of liquid, and was quite turbulent. Again very heavy (hard) precipitation was encountered at the edge of the main body of the cloud, and the profile continued into the "shoulders" of the main cloud. P17 was interrupted at 7.9kft (752mbar, 11.4°C) at the NE edge of the cloud, and was recommenced going SW back into the cloud "shoulders" again. The cloud in this section was definitely mixed phase, and contained some larger ice particles. There was turbulence and at 6.5kft (795mbar, -8.3°C) the aircraft was hit by lightning. P17 was continued on out of the cloud (5.4kft, 830mbar, -6.2°C) and down heading towards waypoint 44 and a line of small Cu to be sampled on route back towards Brecon for recovery to Cranfield. P17 was terminated at 5kft (990mbar p setting) (841mbar, -4.6°C), and R18 started heading through the line of small Cu turrets. CPI reported that these clouds, which were further out into the Bristol Channel, were comprised mainly of liquid water. R18 was terminated and P18 commenced up to FL140 before recovering back to Cranfield. The aircraft landed at 17:22z.

Notes on instrumentation: *(For full list of instrumentation functionality see flight log)*

CVI – generally OK but then iced up after Chilbolton – caused pressure pump to have blown a fuse

2DP – usual noise problem Q) fit CIP-100 (PIP) before next flight ?
CPI - least significant bit line driver blown (after lightning strike) – kept measuring on this flight. Need to remove to repair before next flight.
Nevzorov total water probe – failed during flight again – vane died?
CCN water CPC – flow issue to resolve. Switch for pump is loose.
SO2 – low p alarms
Ozone - readings suspected to be a bit lower than should be
Internet – very very slow

Final comments: For further information about flight refer to Mission Scientist log sheets and screen dump file.



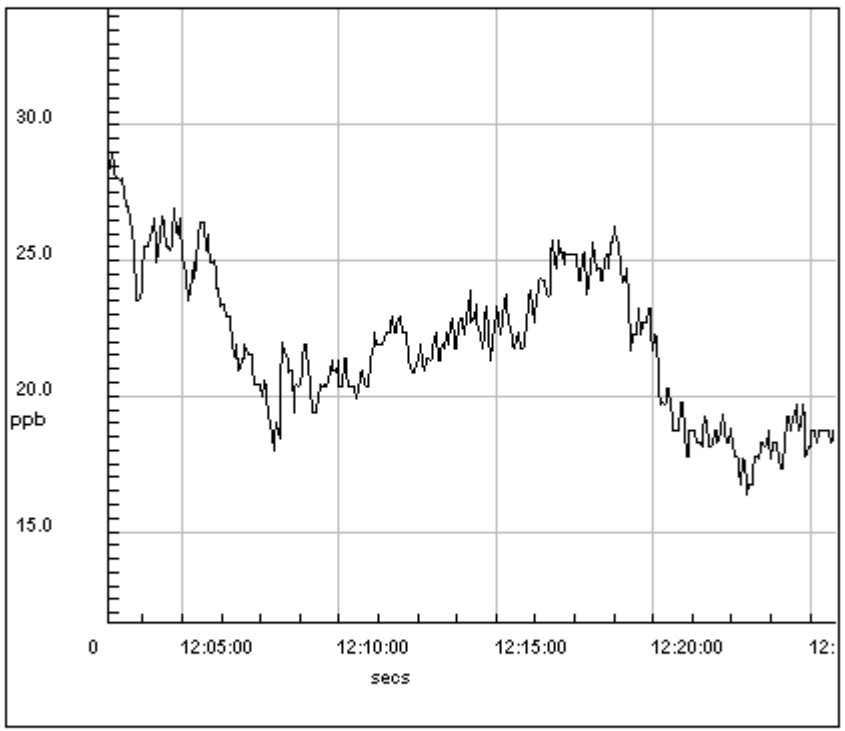
Transit FL100

http://horace/plot/plot.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

New plot, same times

Flight B423 12:25:49
Heading 250 deg Speed 277 knots Height 18.0kft Press 505mb
Lat 51°54.0'N Long 2°18.0'W Wind 14 ms-1/ 232 deg
Temp -35.22C Dewpoint -37.22C
From 12:00:00 to now



Current values

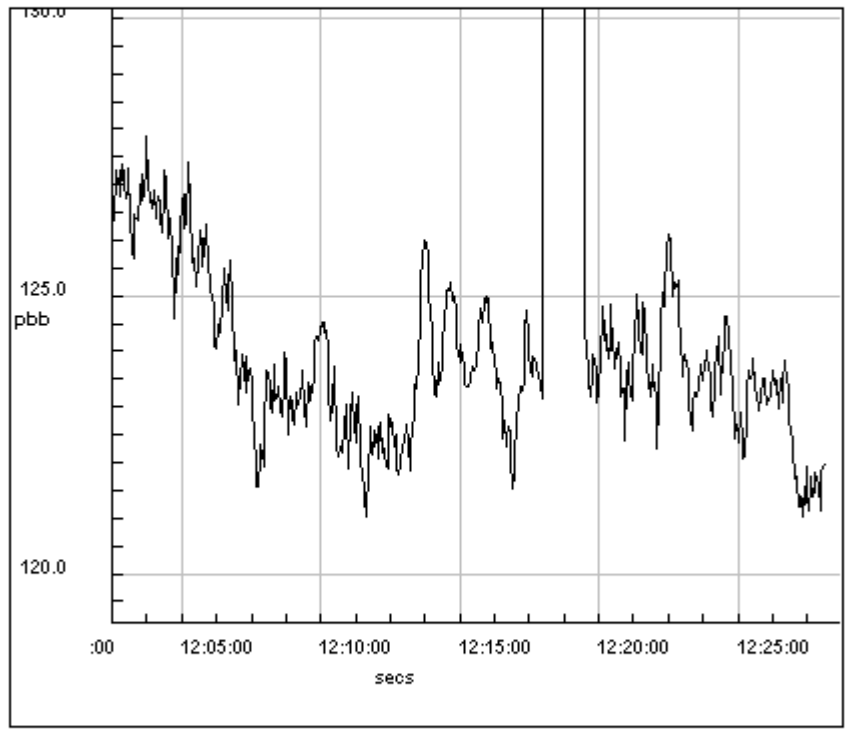
TIME FROM MIDNIGHT	44748	secs	All	sc
OZONE MIXING RATIO	18.74	ppb		

http://horace/plot/plot.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

New plot, same times

Flight B423 12:28:07
Heading 250 deg Speed 275 knots Height 18.0kft Press 505mb
Lat 51°48.0'N Long 2°30.0'W Wind 14 ms-1/ 235 deg
Temp -35.17C Dewpoint -40.84C
From 12:00:00 to now



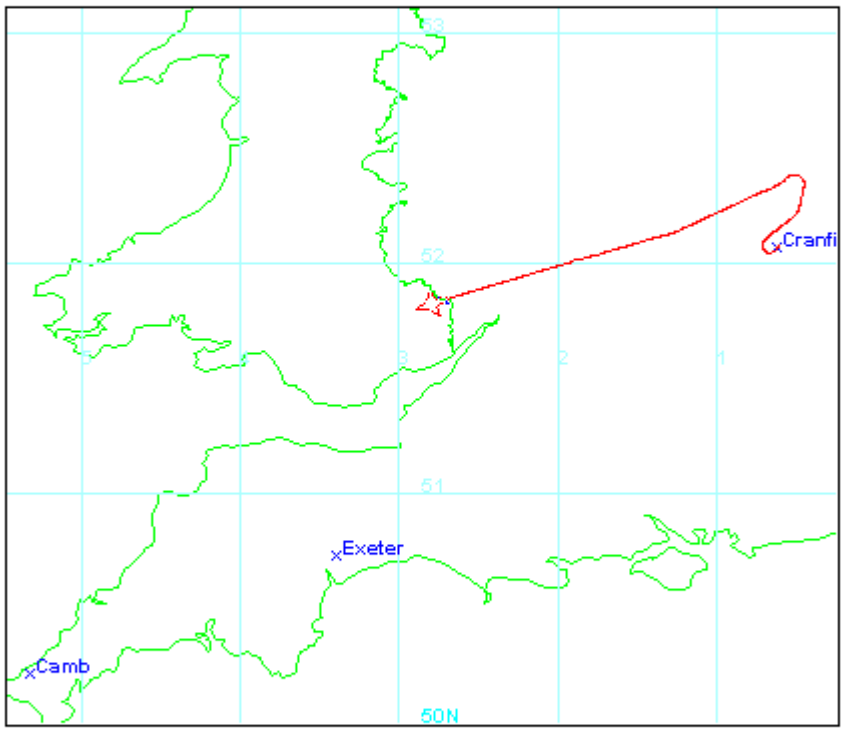
Current values

TIME FROM MIDNIGHT	44886	secs	All	sc
CO MIXING RATIO	121.96	pbb		

http://horace/plot/plot.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Flight B423 12:29:16
Heading 250 deg Speed 281 knots Height 18.0kft Press 505mb
Lat 51°48.0'N Long 2°42.0'W Wind 15 ms-1/ 232 deg
Temp -35.32C Dewpoint -37.38C
From 12:00:00 to now



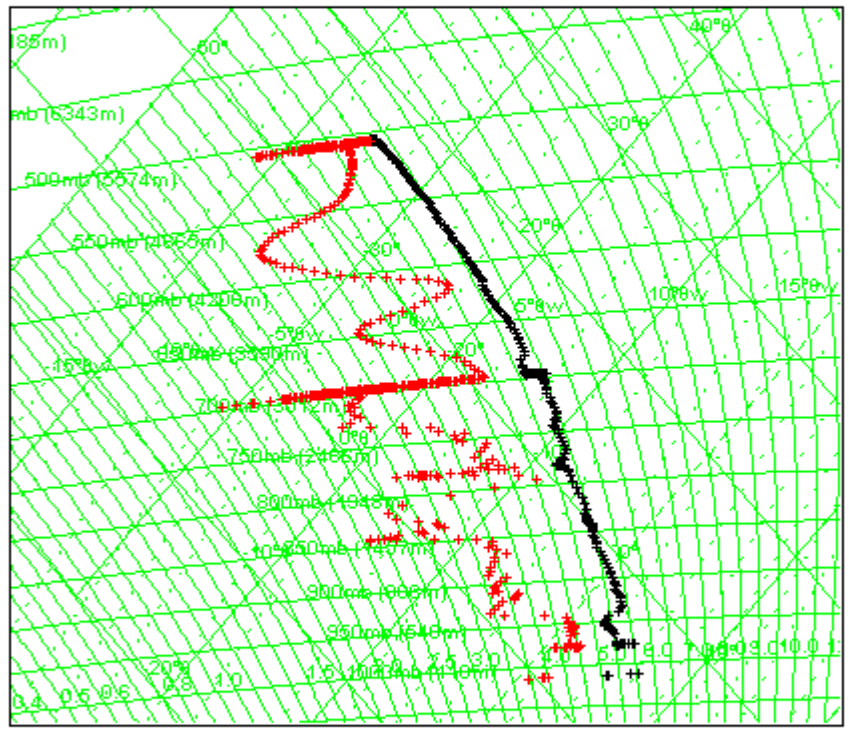
Current values

GIN LONGITUDE	-2.71	deg (+ve E)	Draw plane
GIN LATITUDE	51.84	deg (+ve N)	

http://horace/plot/plot.html - Microsoft Internet Explorer

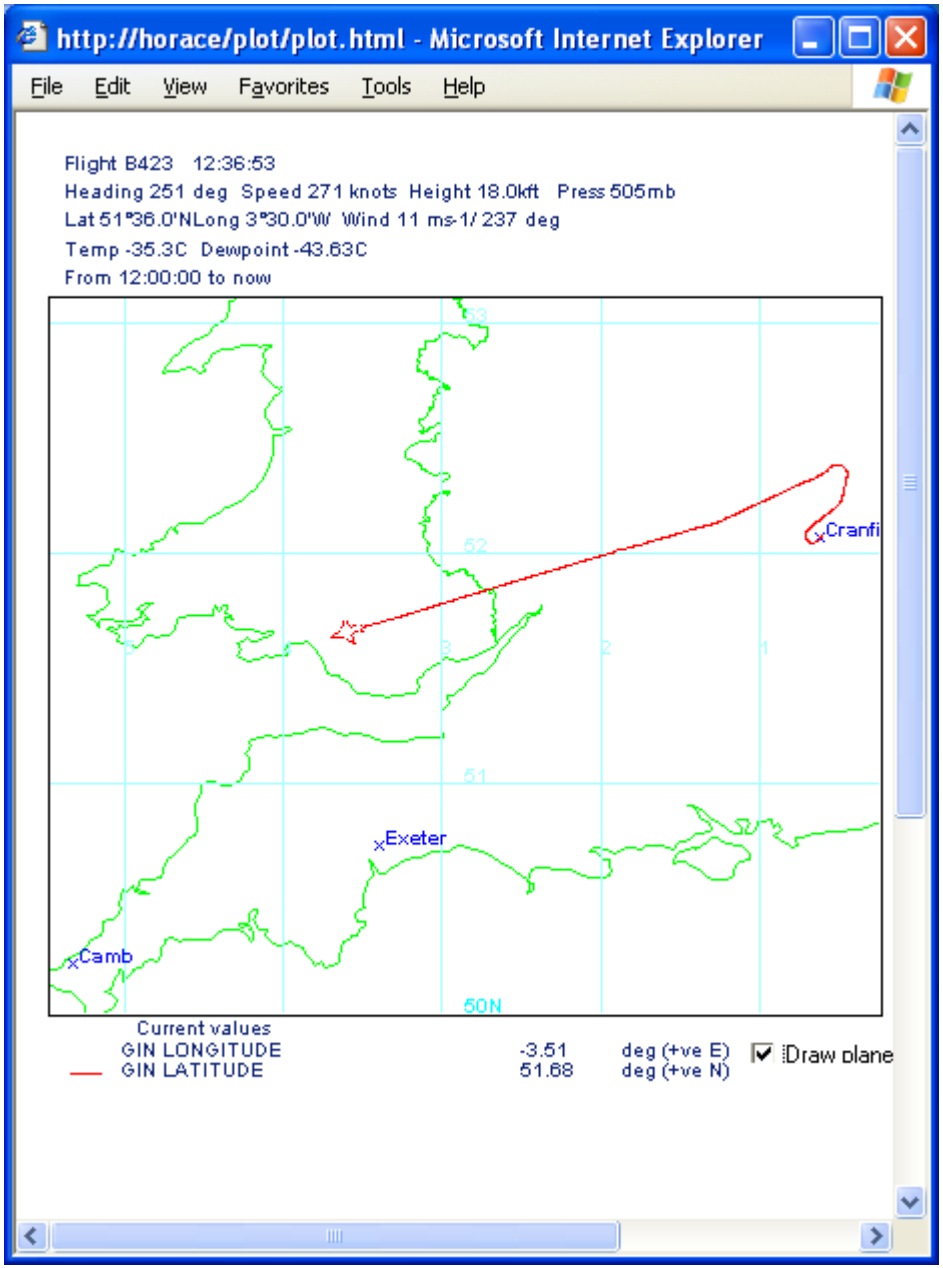
File Edit View Favorites Tools Help

Flight B423 12:30:25
Heading 250 deg Speed 277 knots Height 18.0kft Press 505mb
Lat 51°48.0'N Long 2°48.0'W Wind 15 ms-1/ 232 deg
Temp -35.36C Dewpoint -38.72C
From 12:00:00 to now

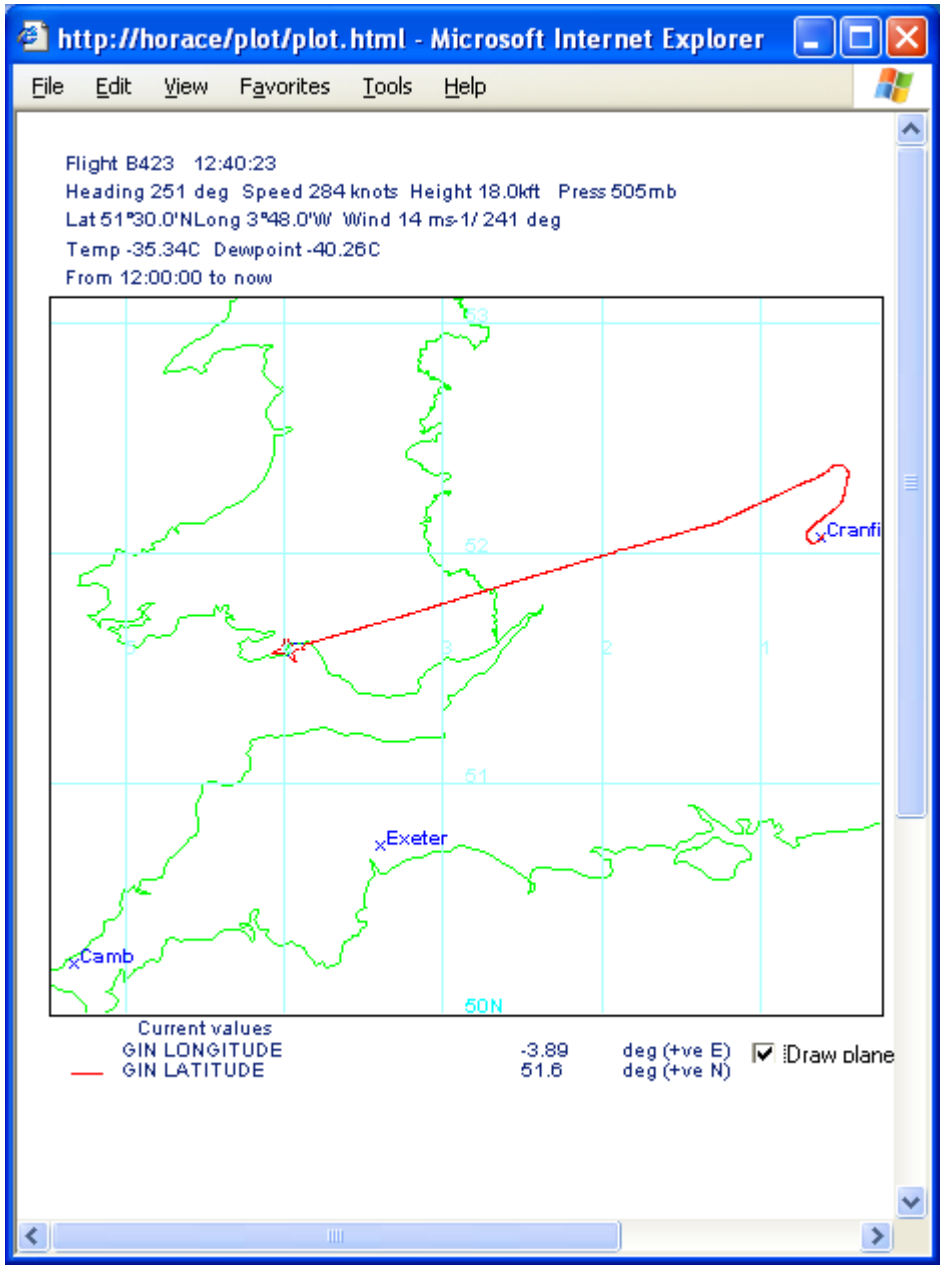


Current values

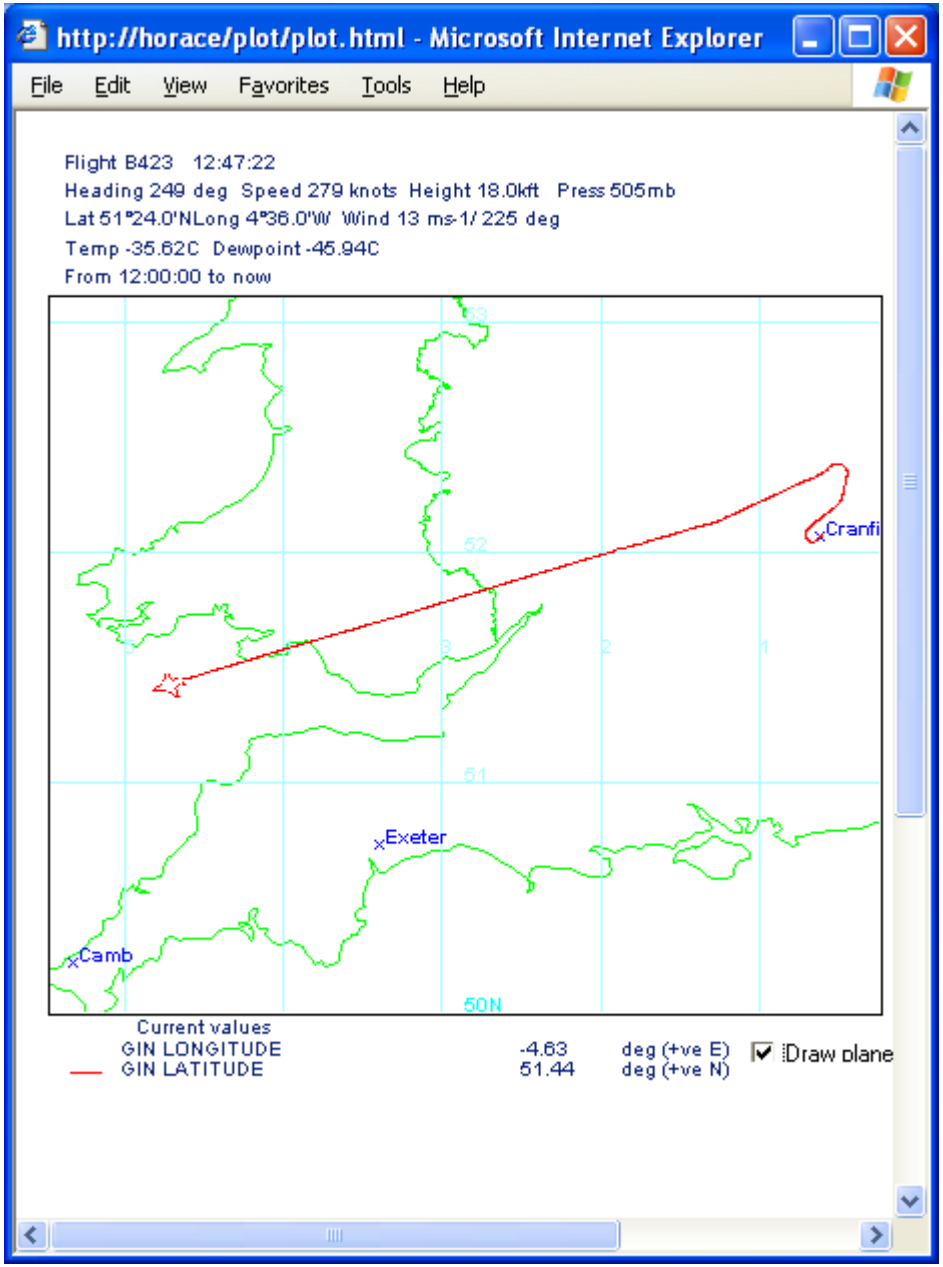
STATIC PRESSURE	505.81	mb
DEICED TRUE AIR TEMP	-35.36	deg C
DEW POINT	-38.73	deg C



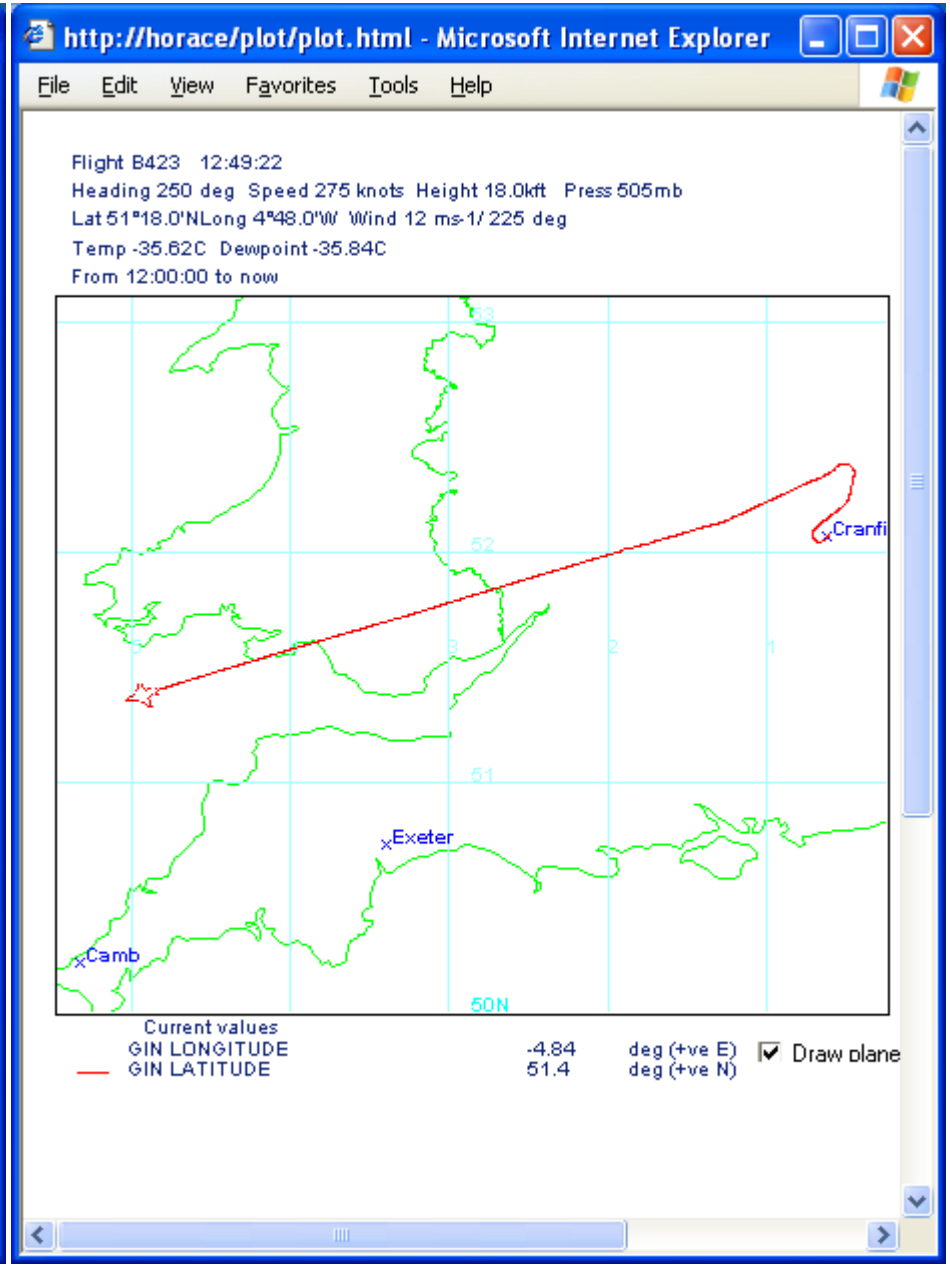
Large CU + anvil to our LHS



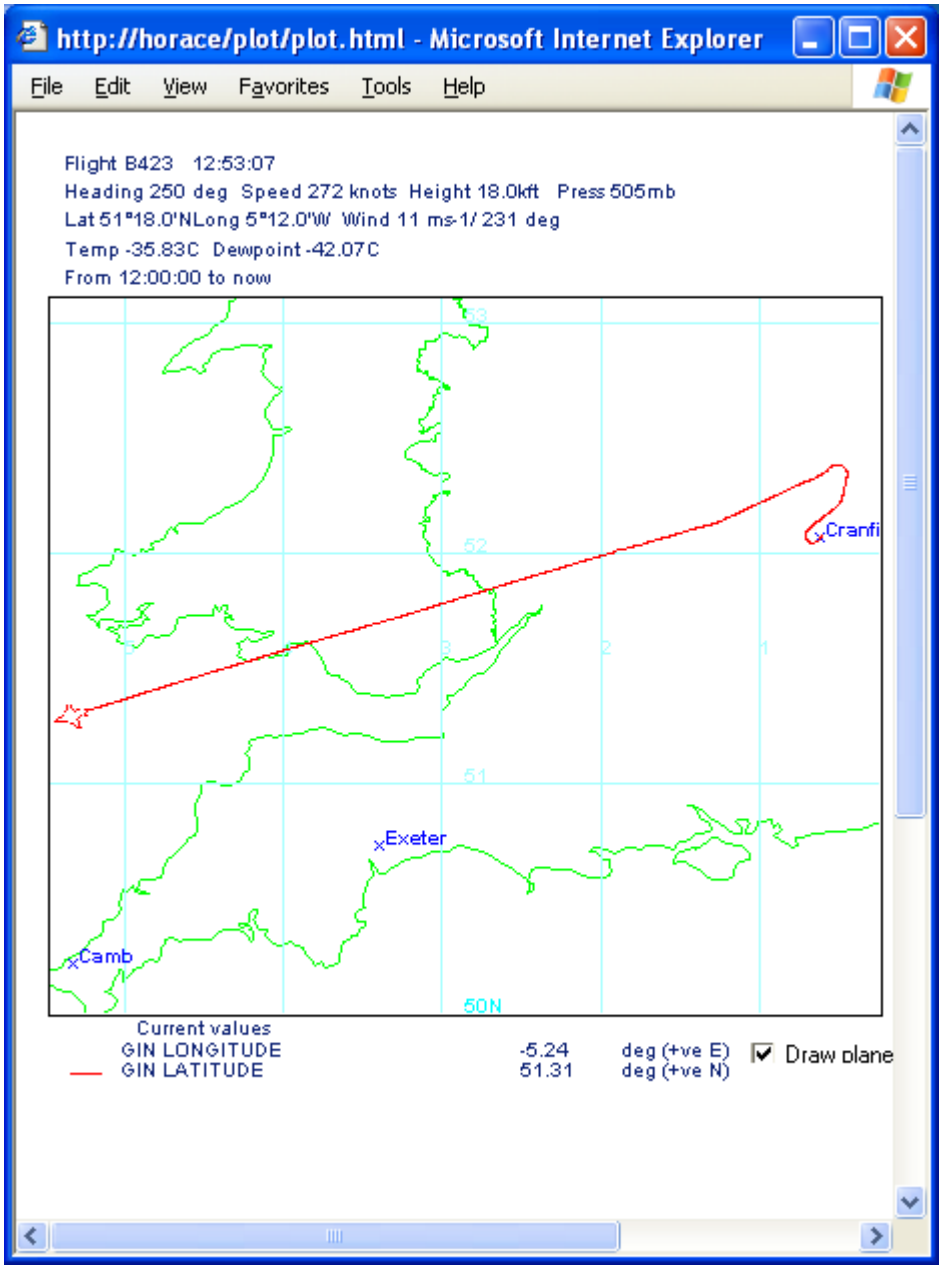
Many small convective clouds ahead/ left/right + some bigger turrets with anvils



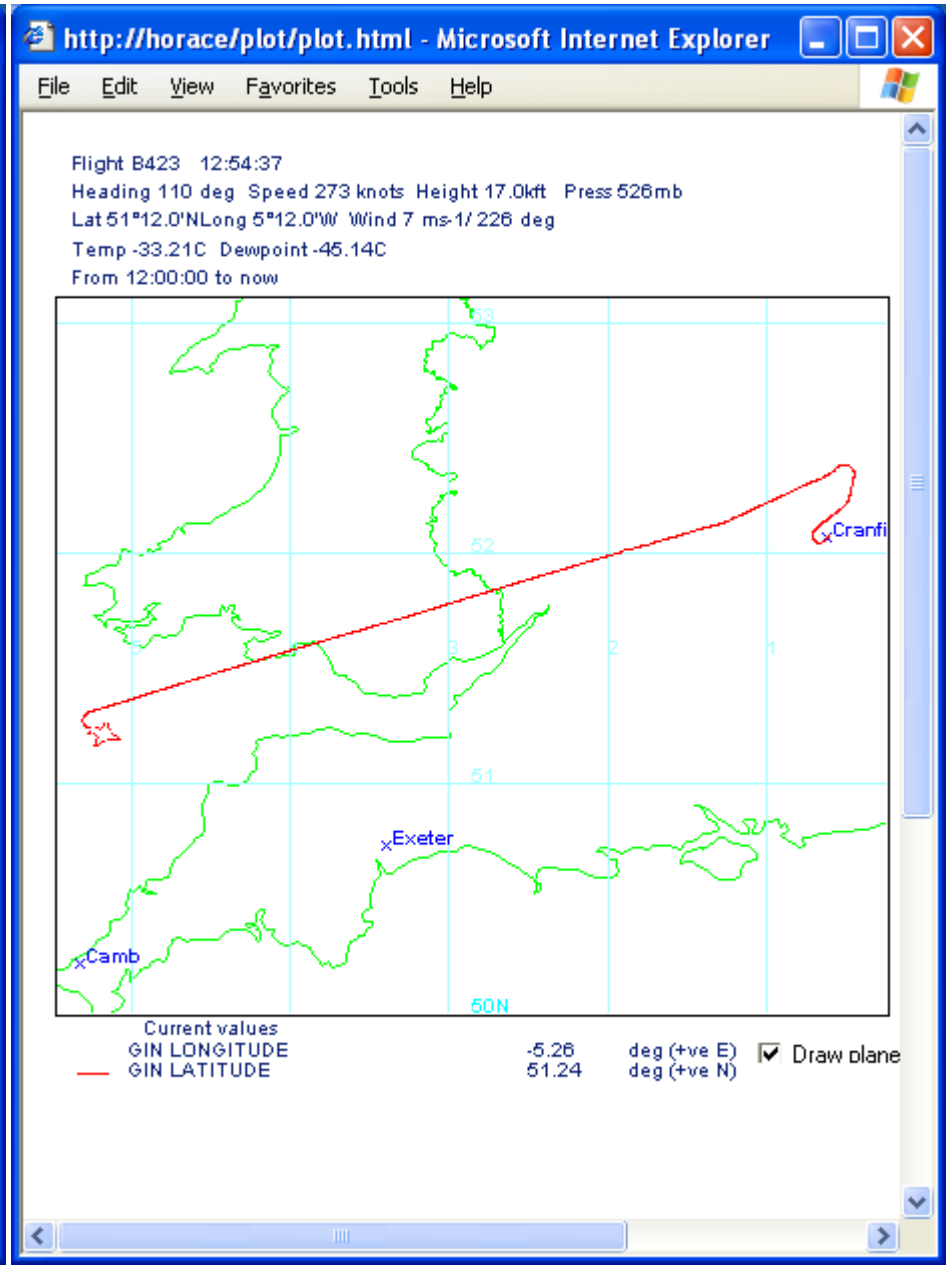
Into turret



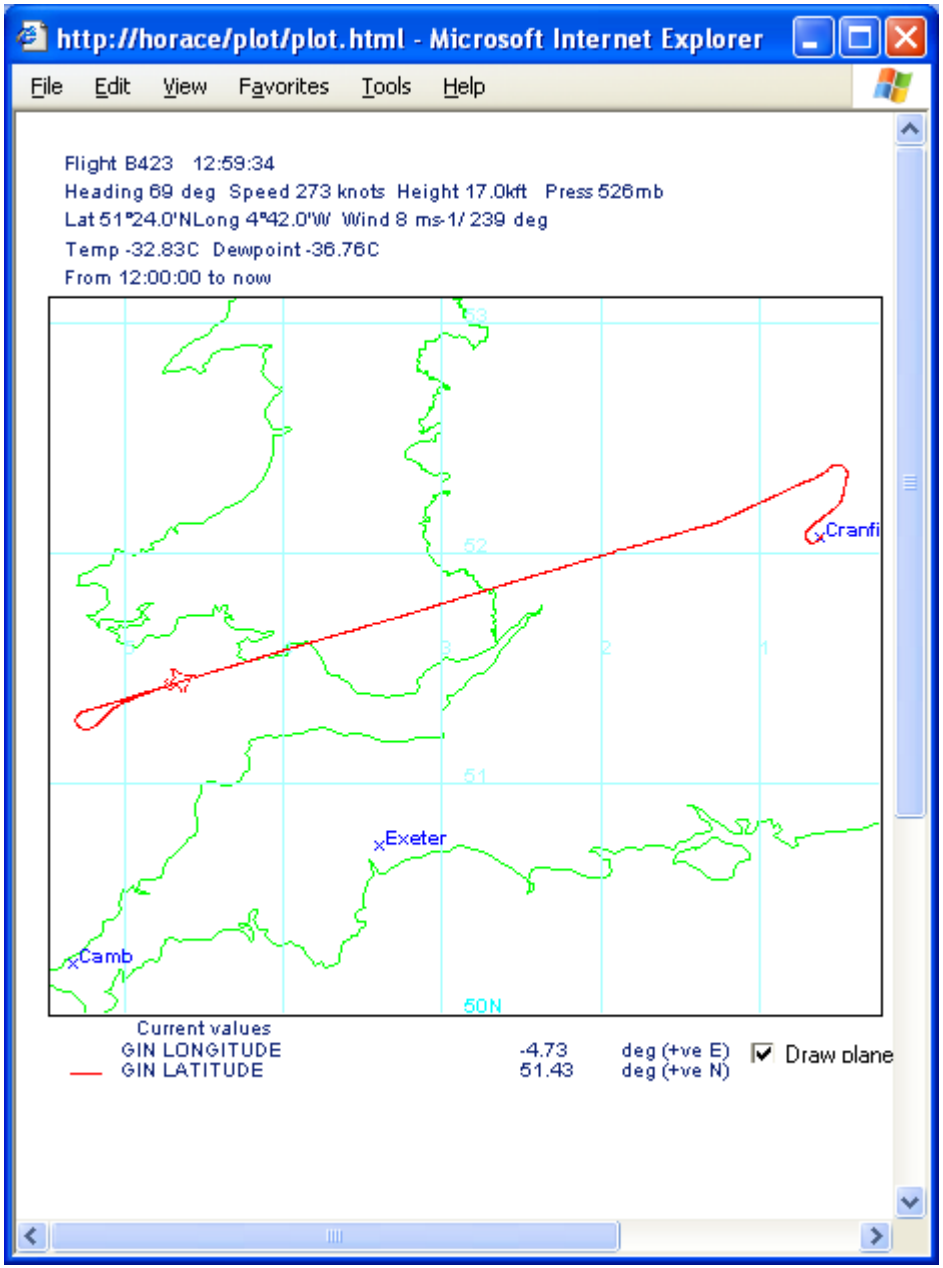
Out of turret

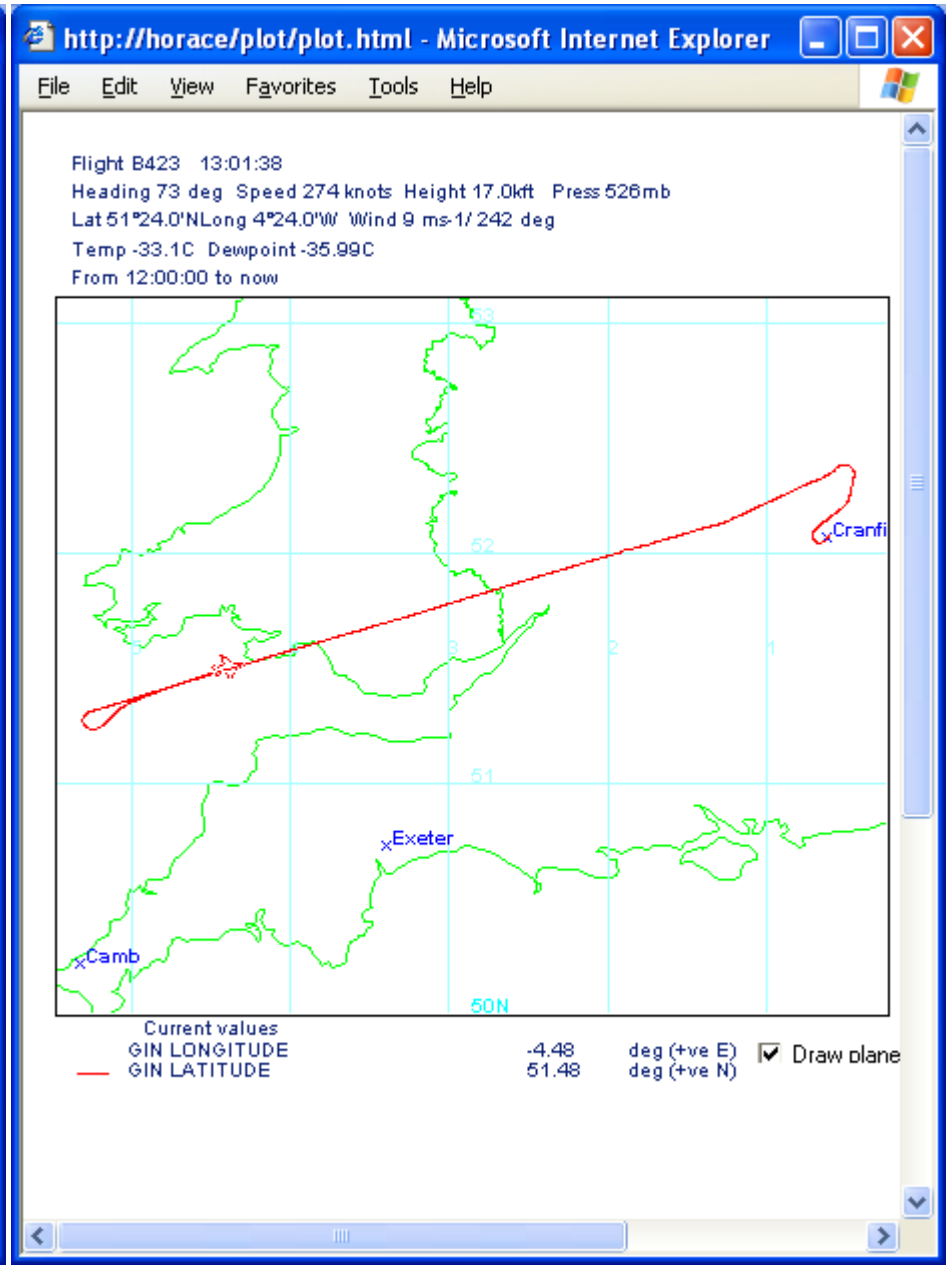


End R1 P1 down 1000ft



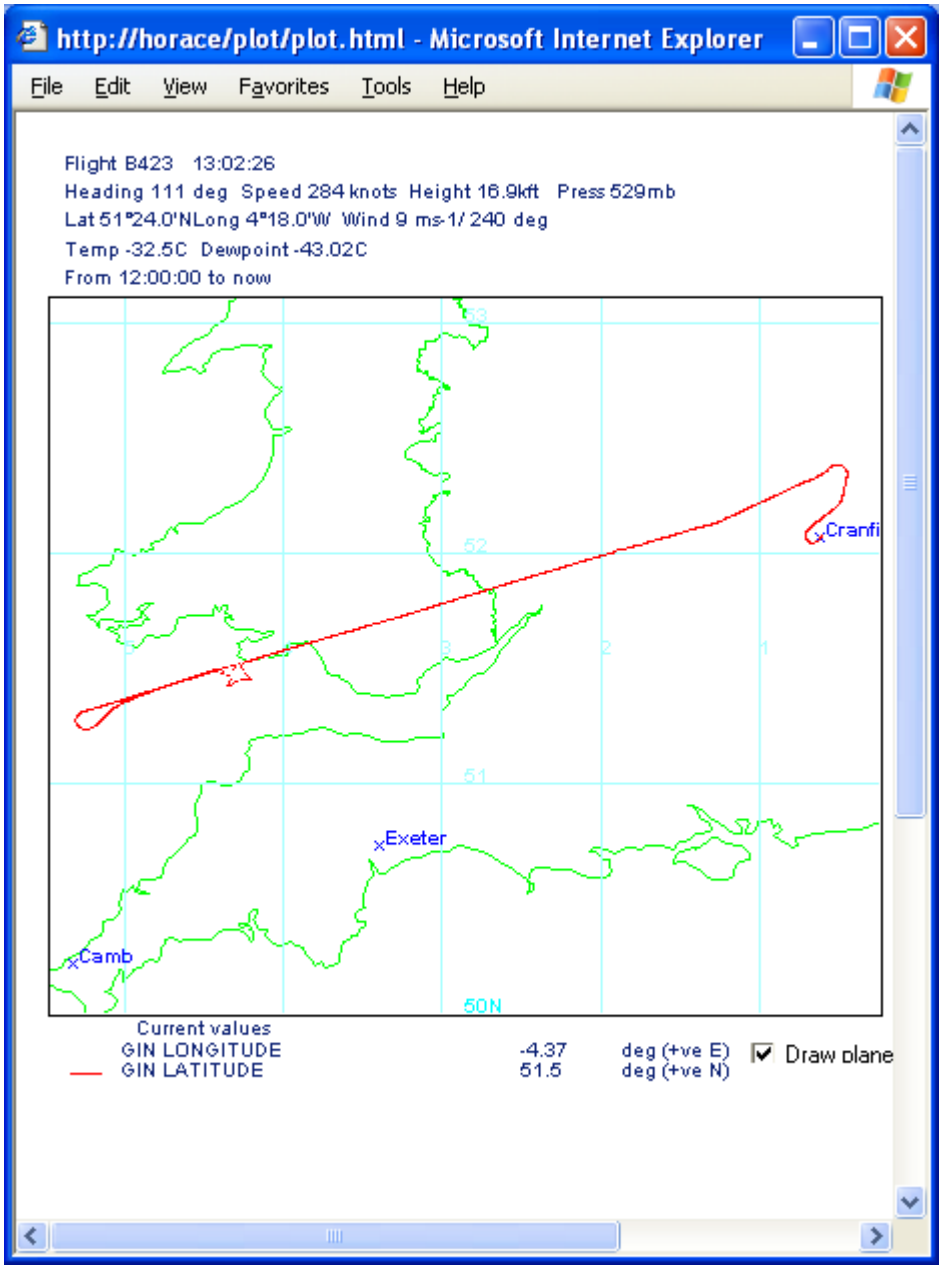
End P1 down 1000ft – start R2



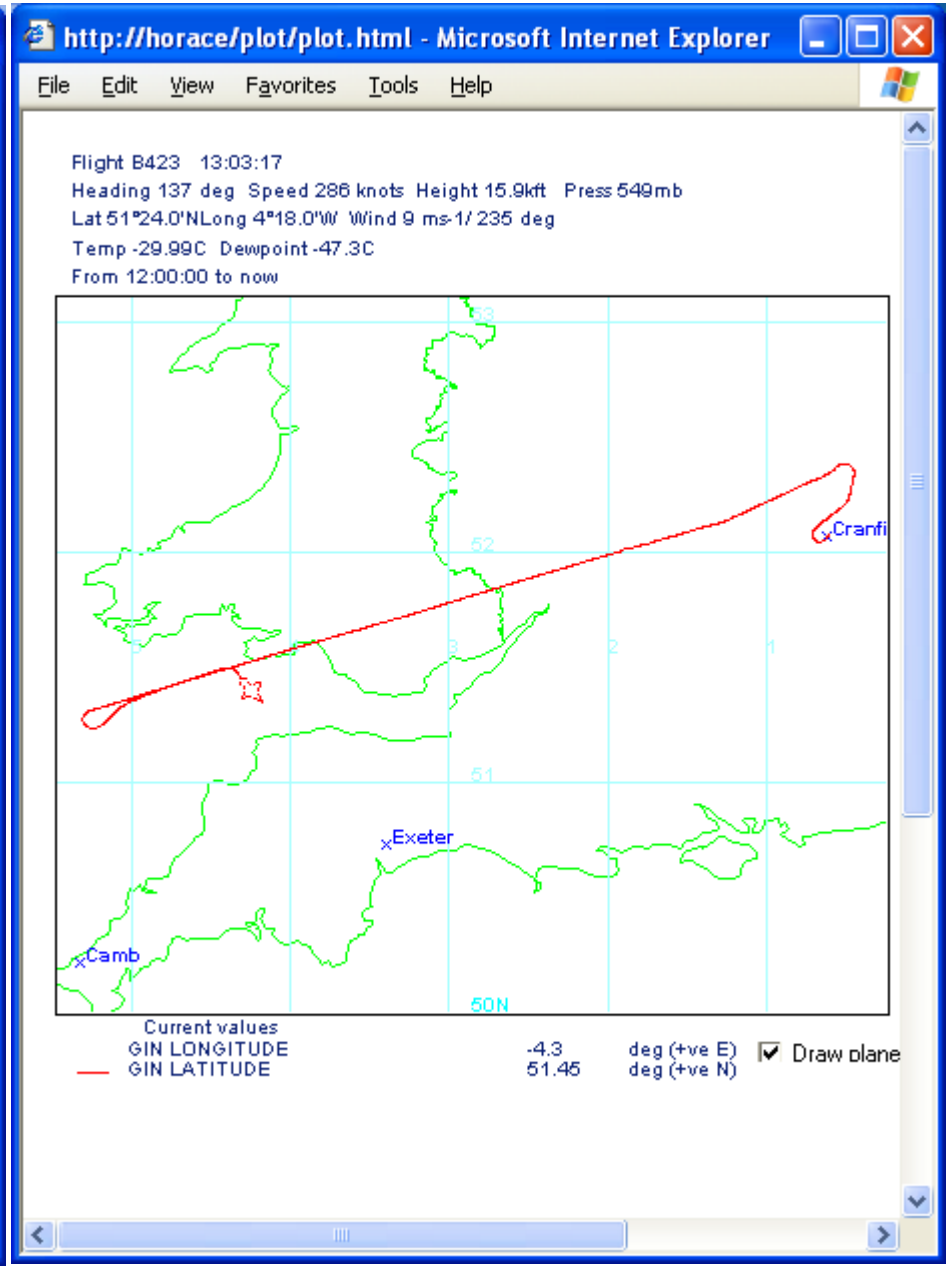


Entering cloud R2

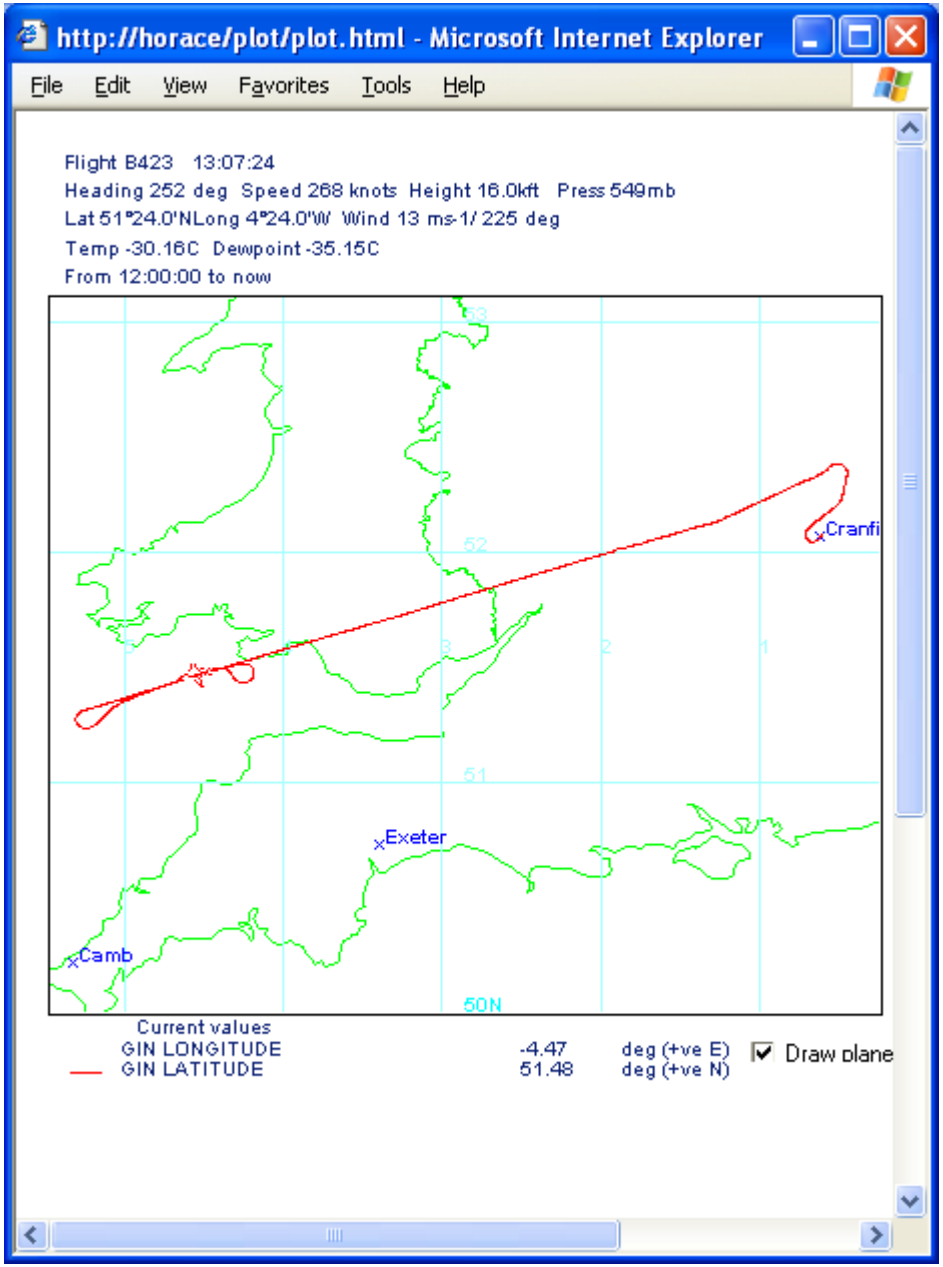
Out of cloud



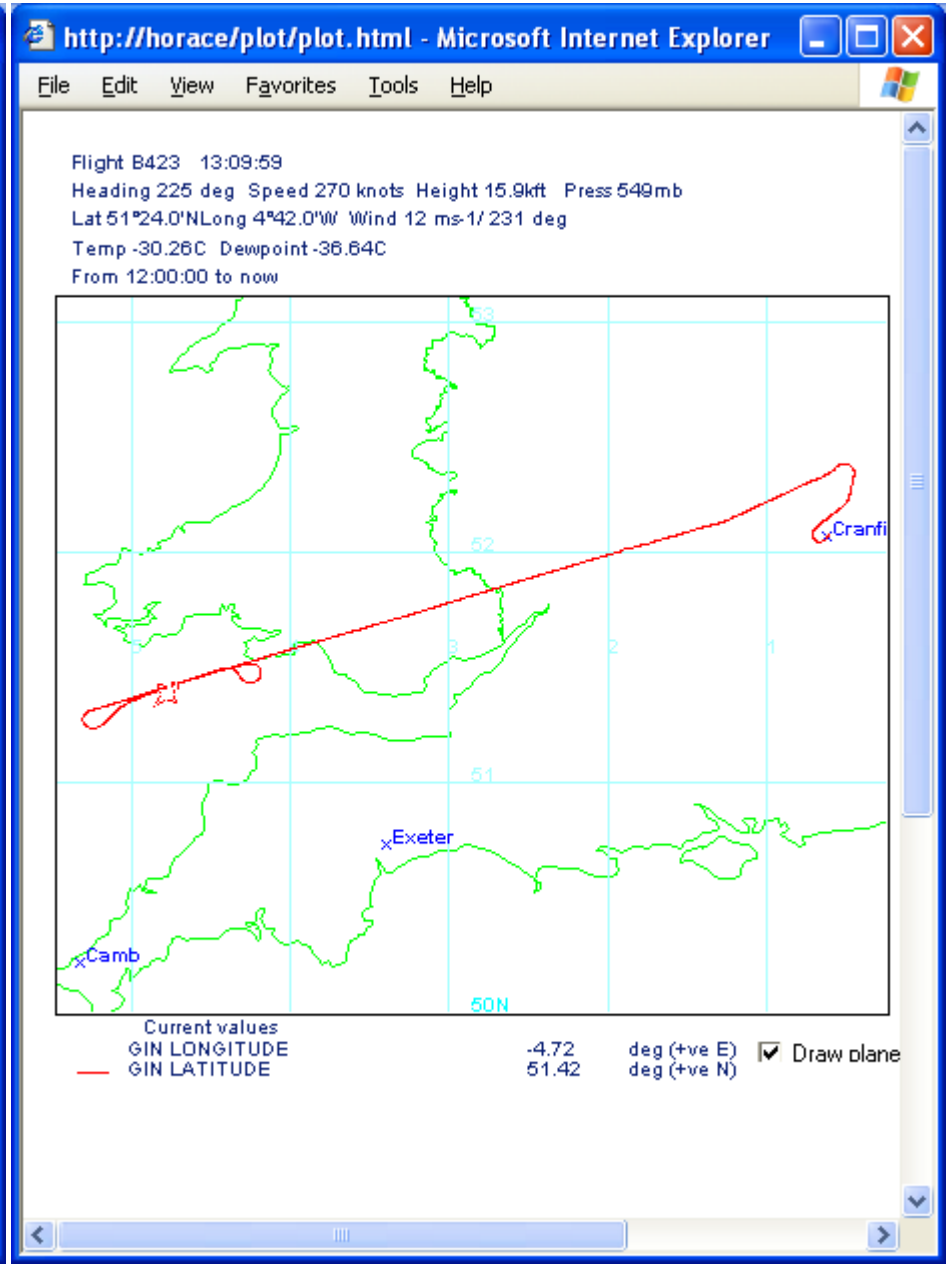
R2 end P2 start FL170



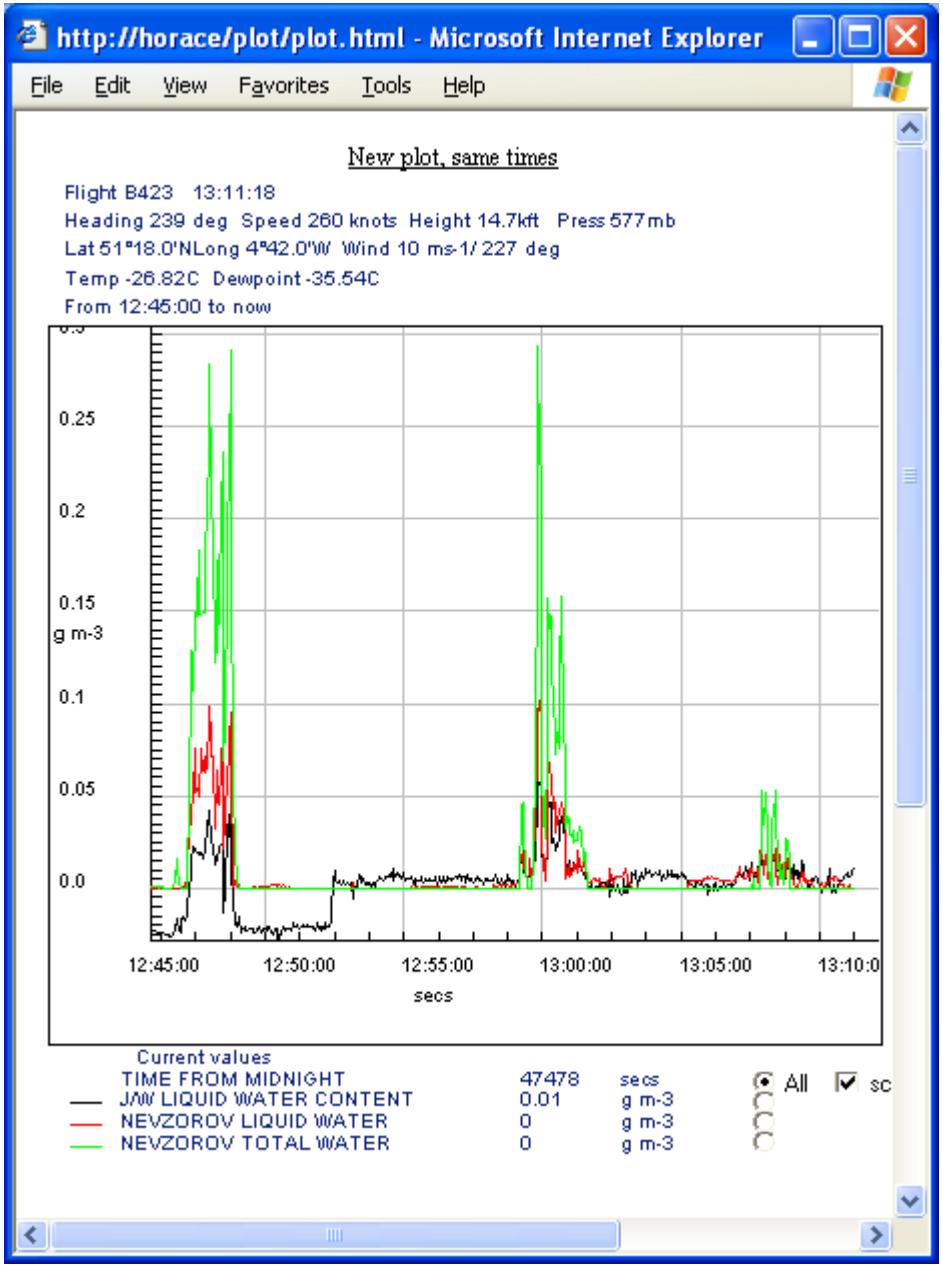
End P2 start R3 FL160

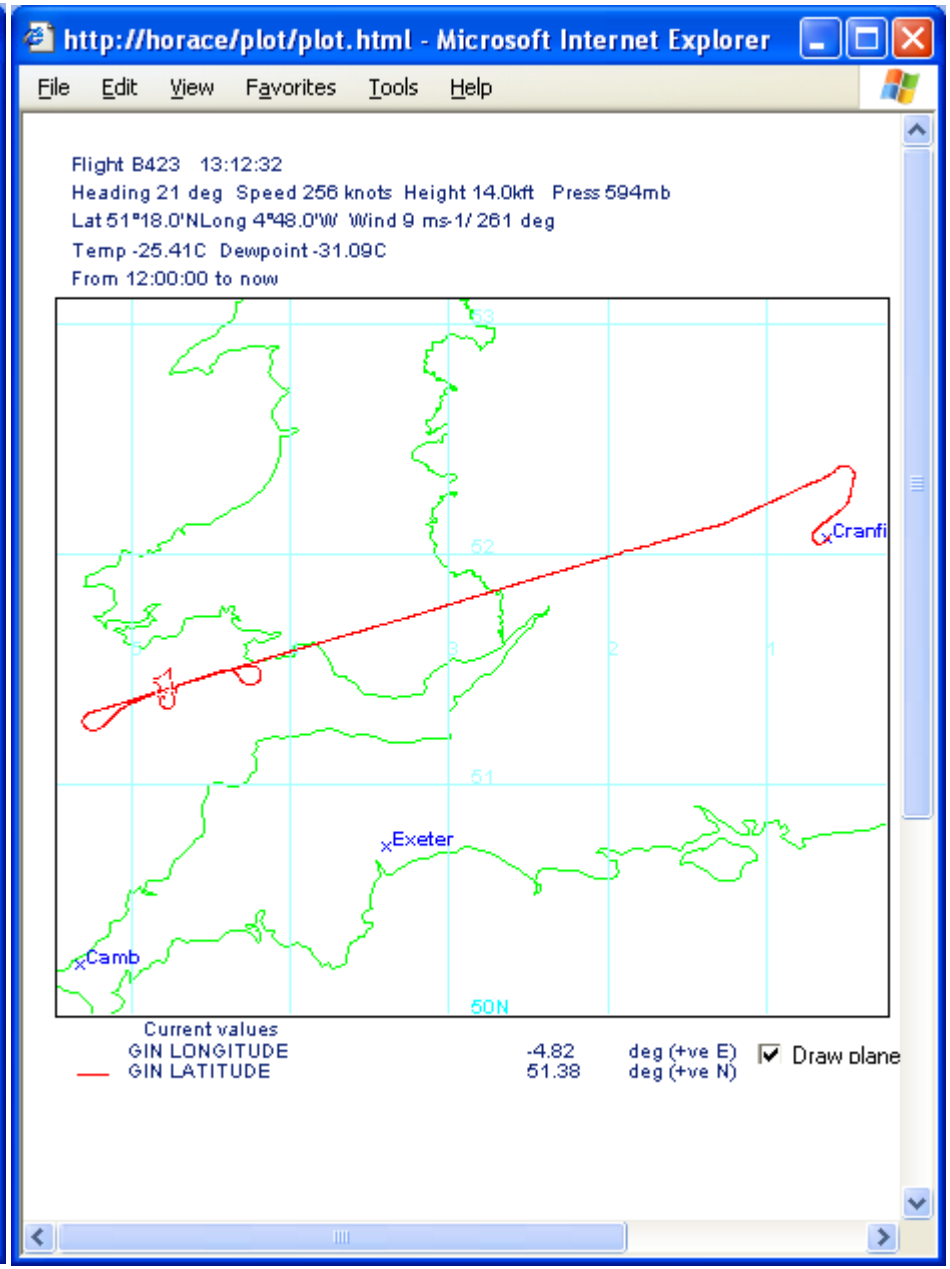


R3 into cloud

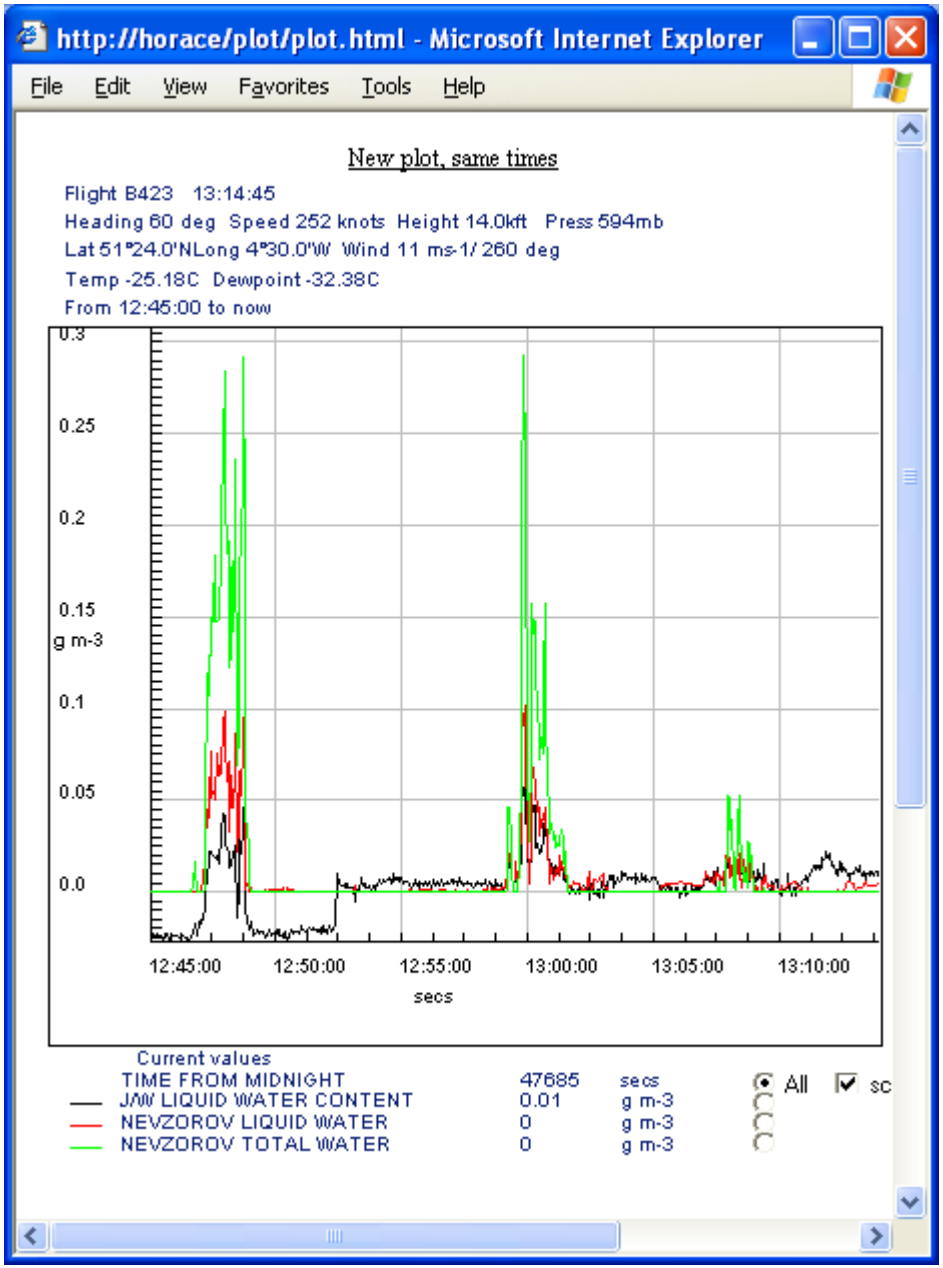


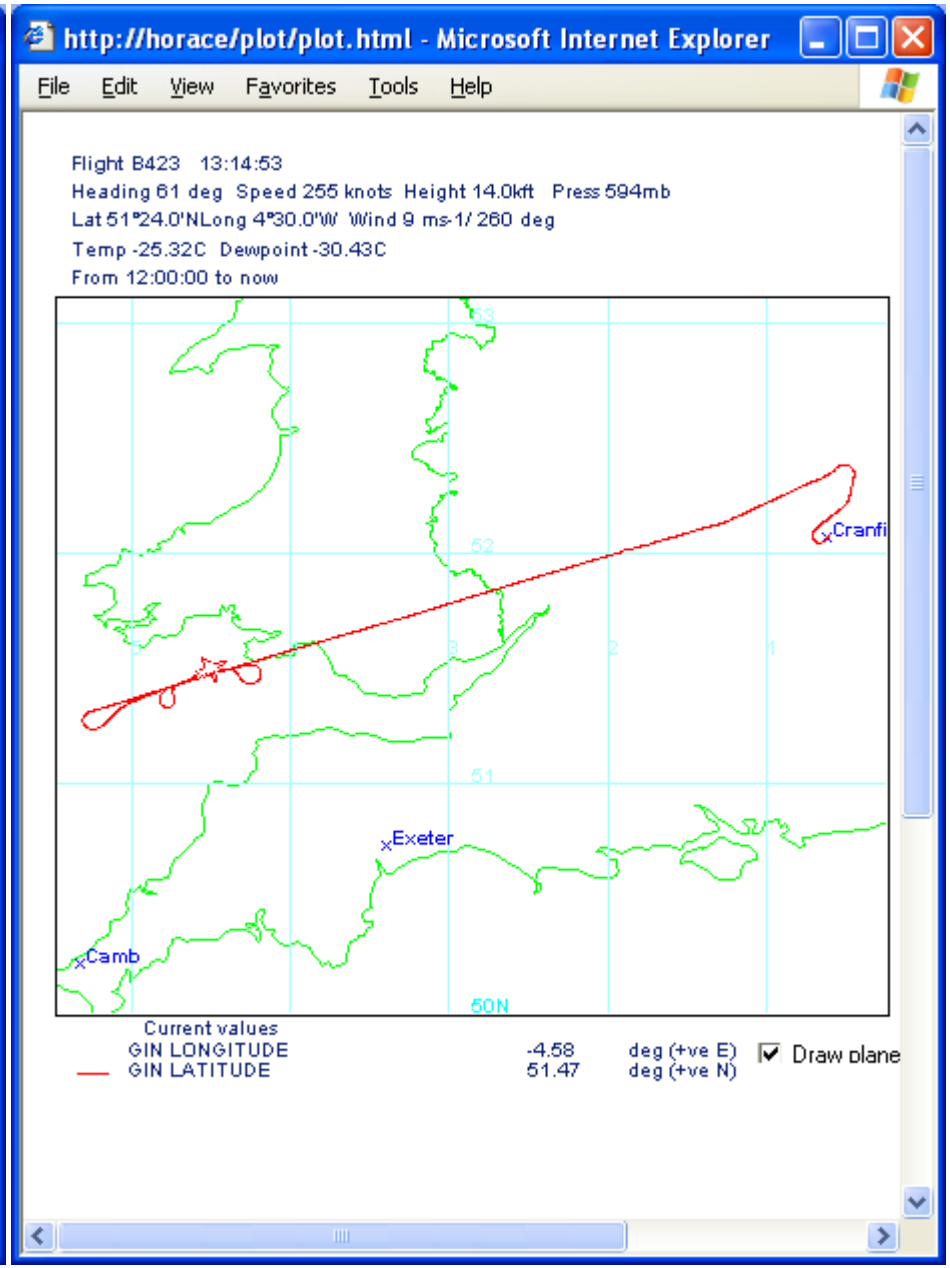
End R3 start P3 FL160



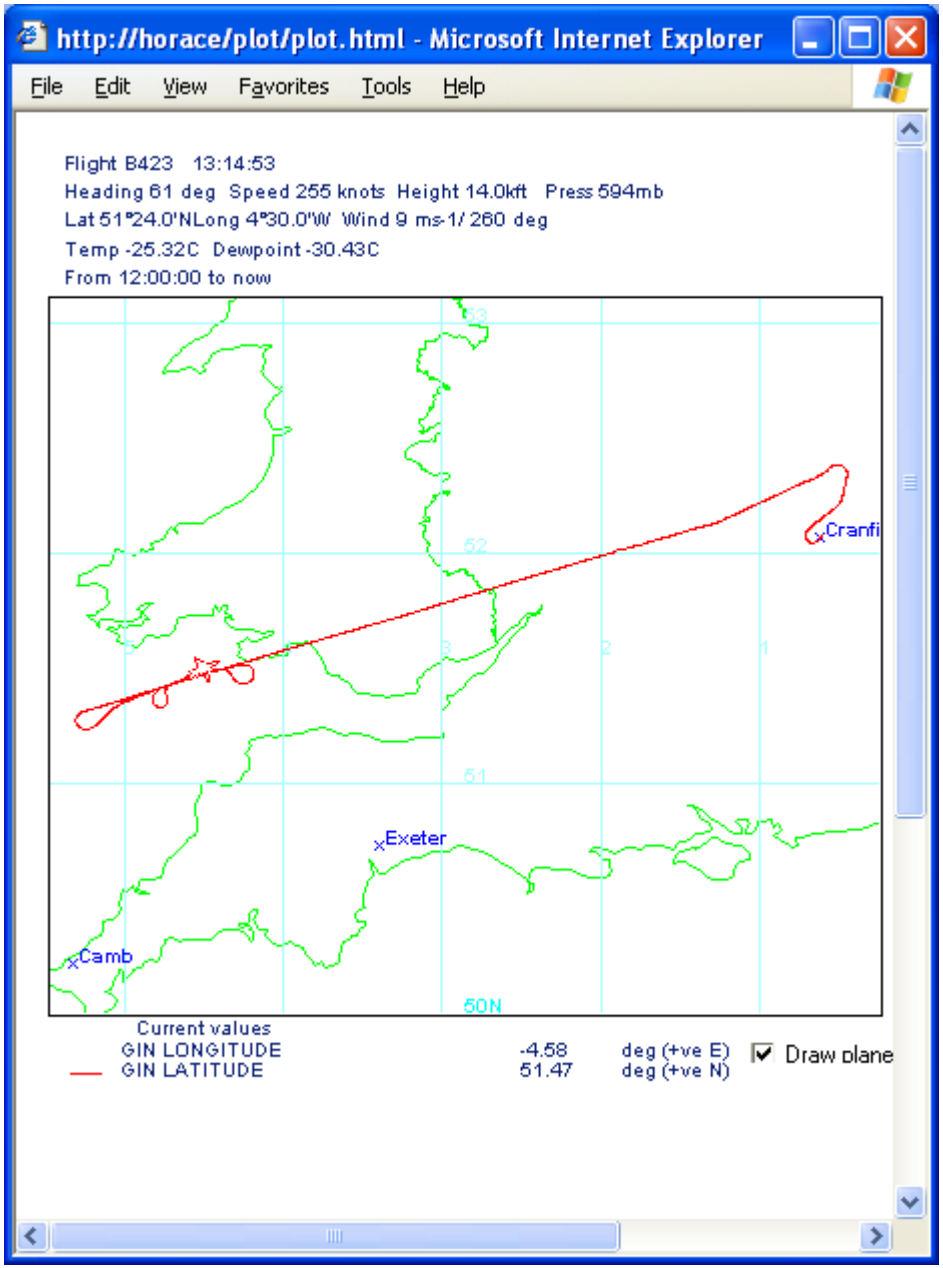


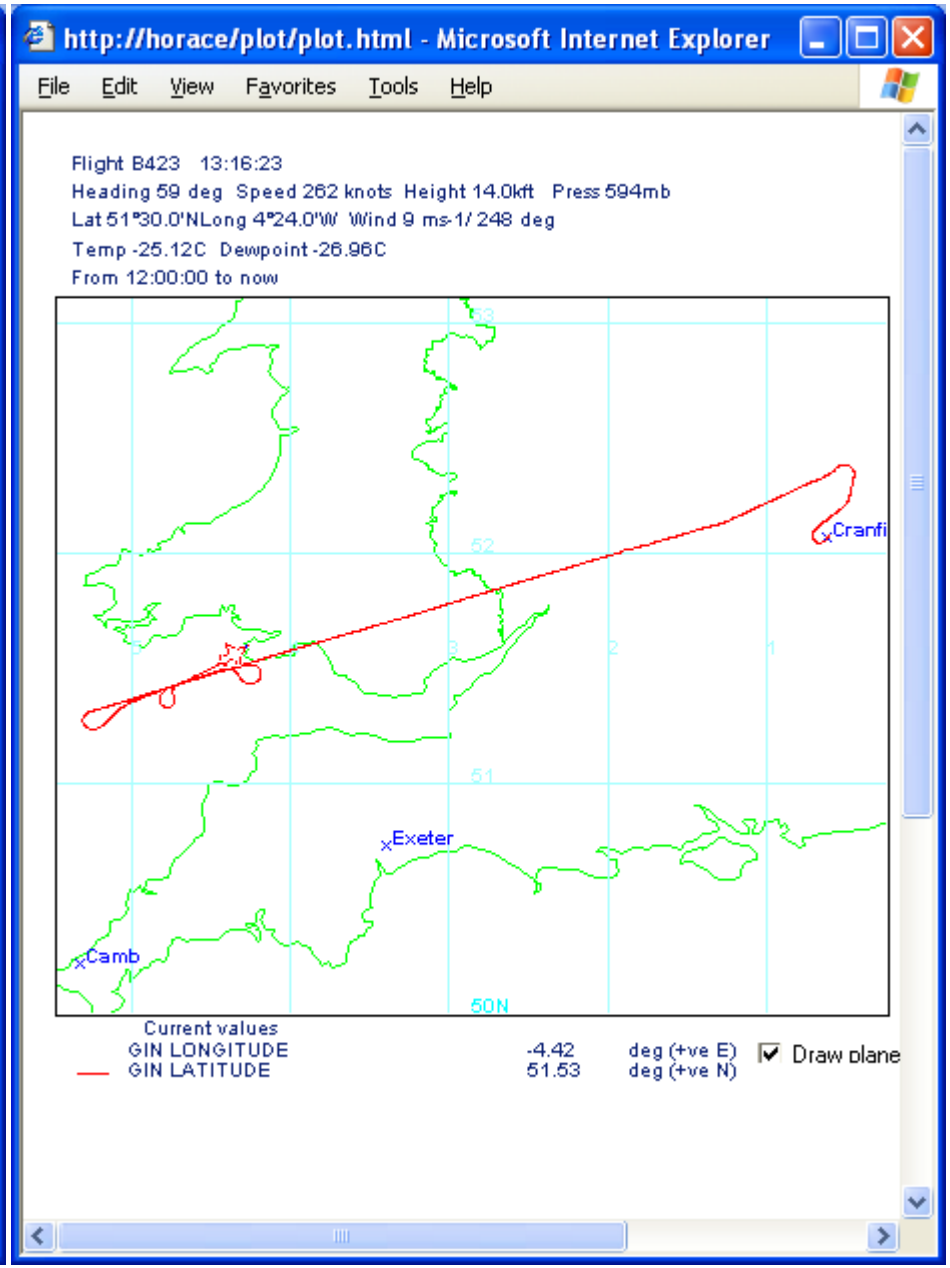
End P3 start R4 at FL140



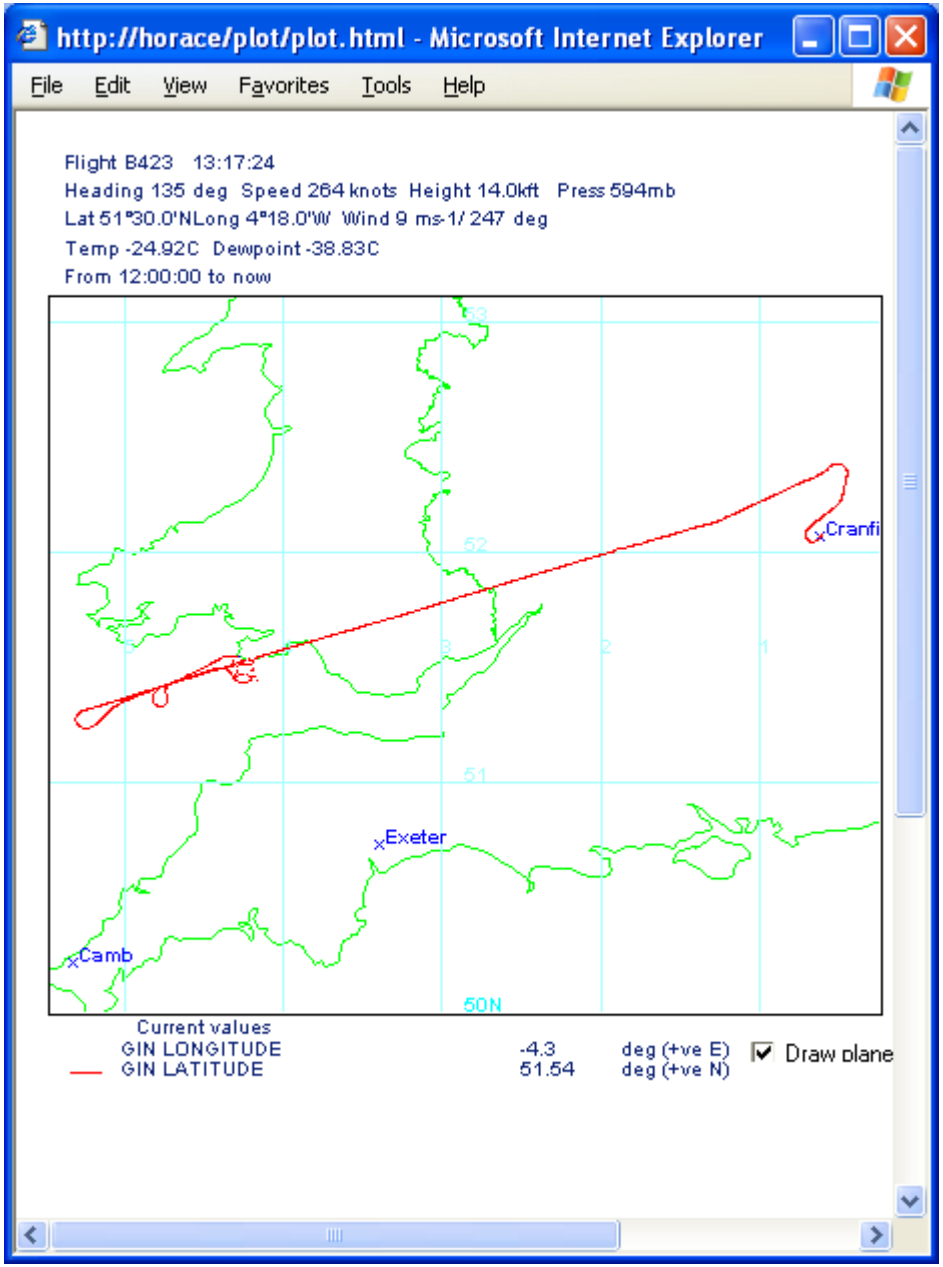


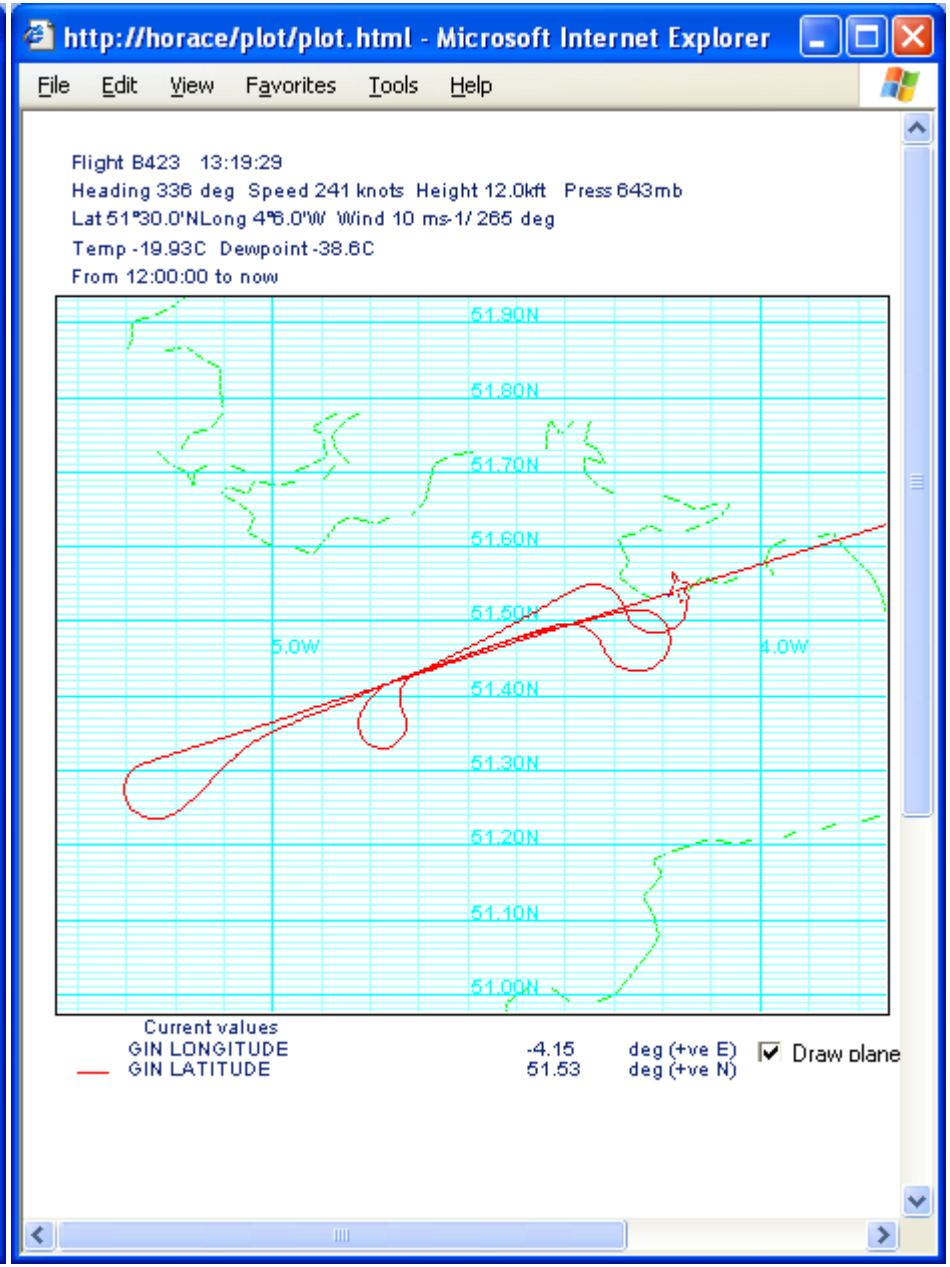
Going into cloud again





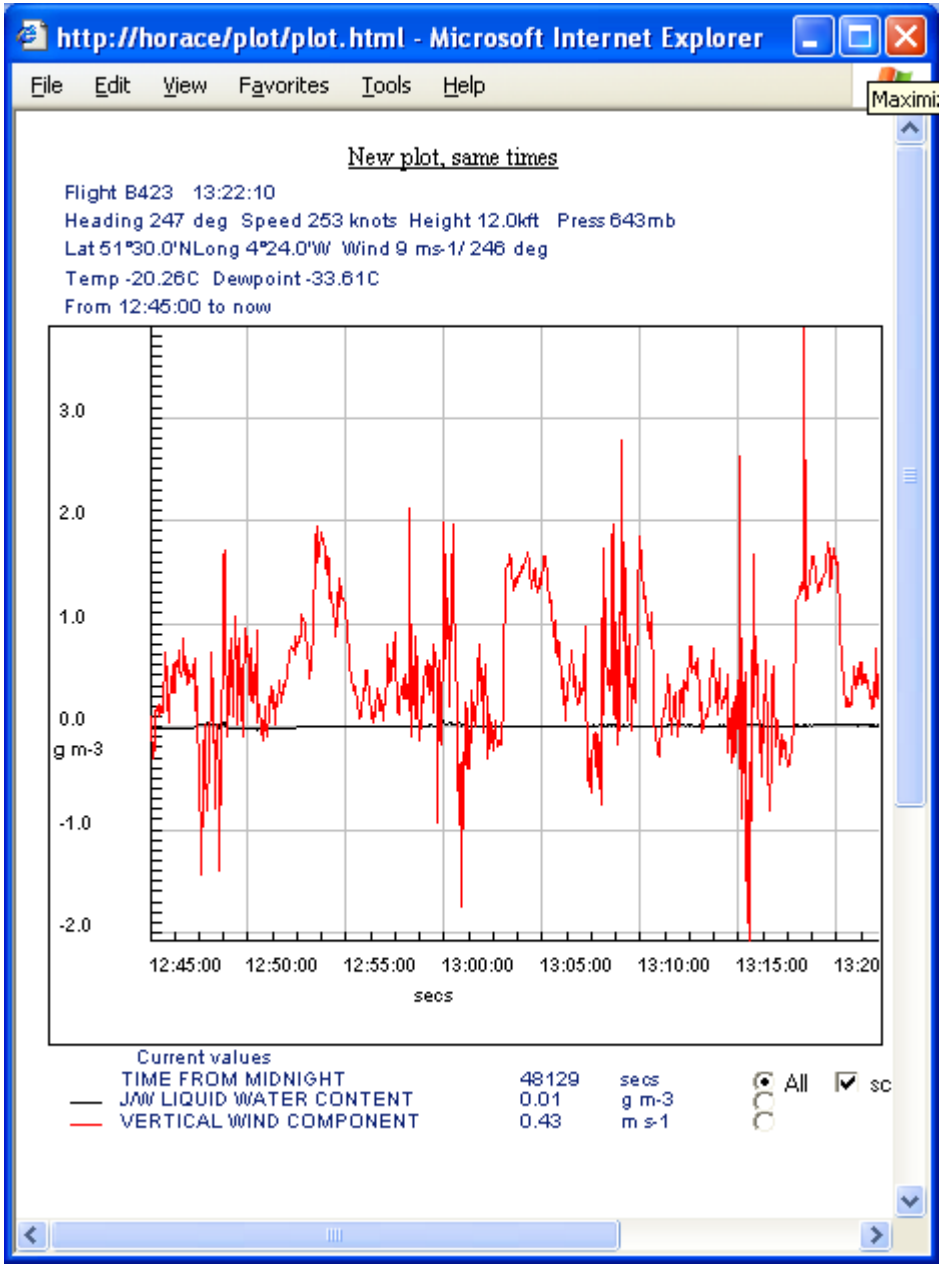
Leaving cloud

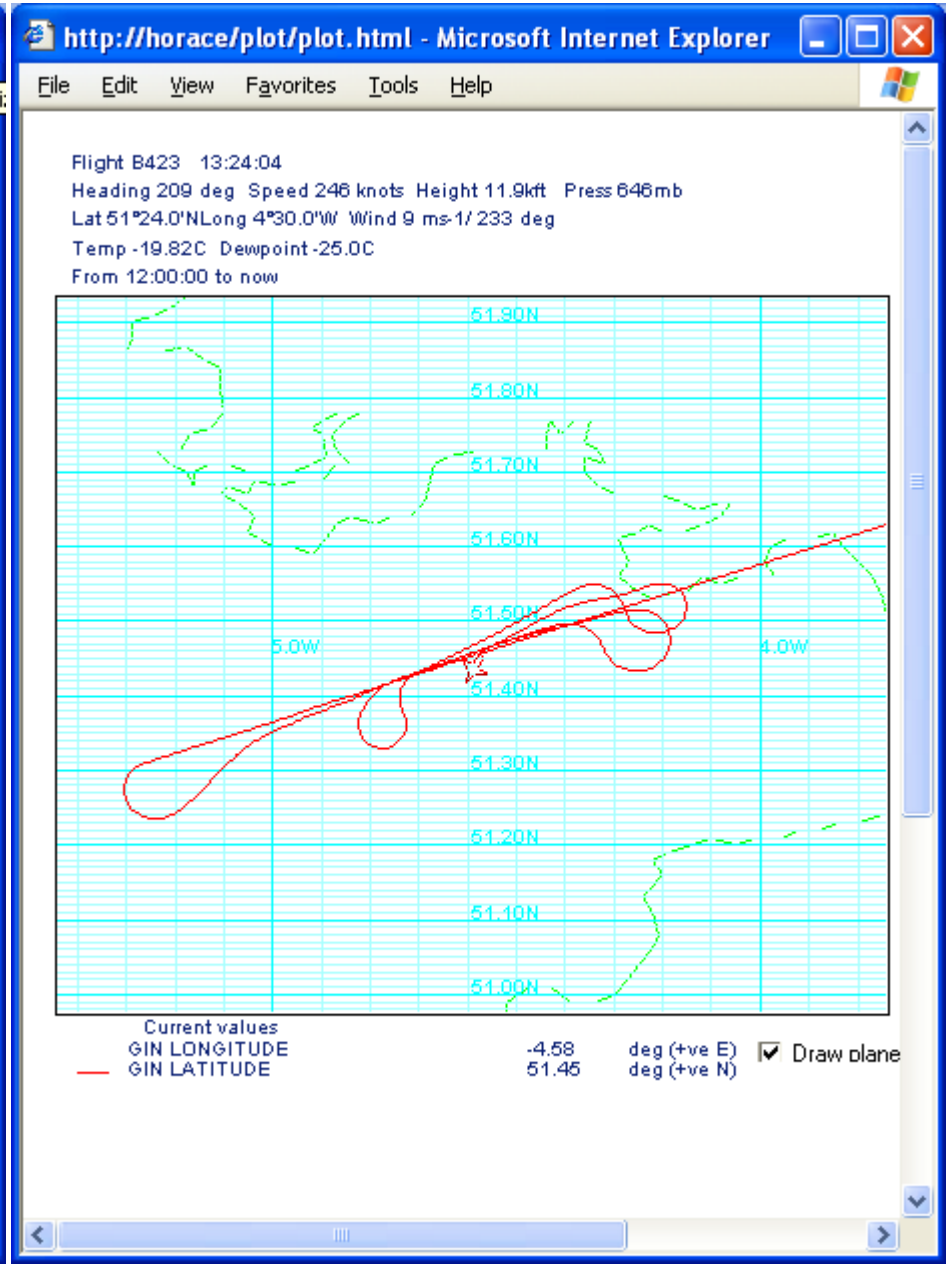




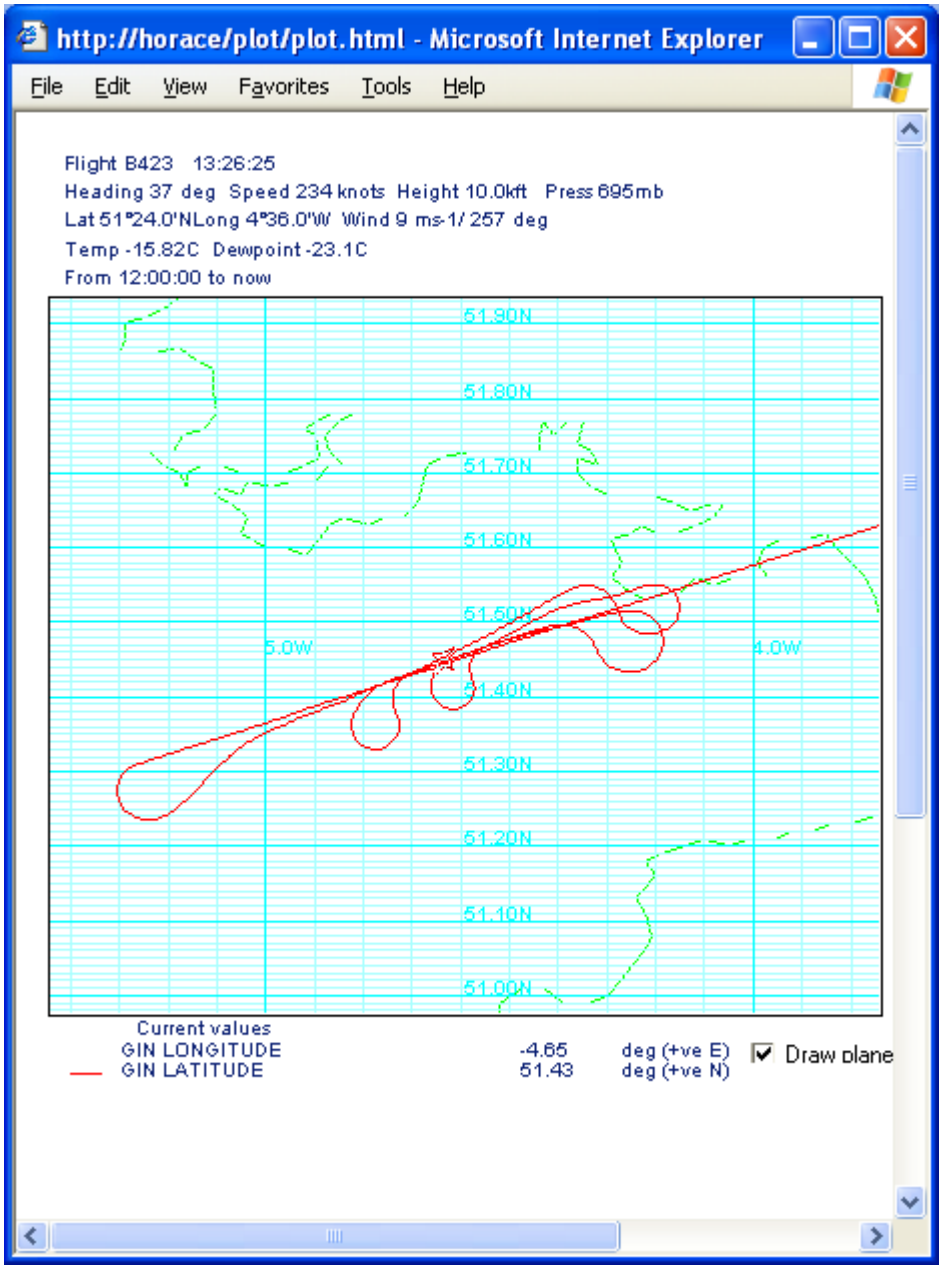
End R4 start P4 FL140

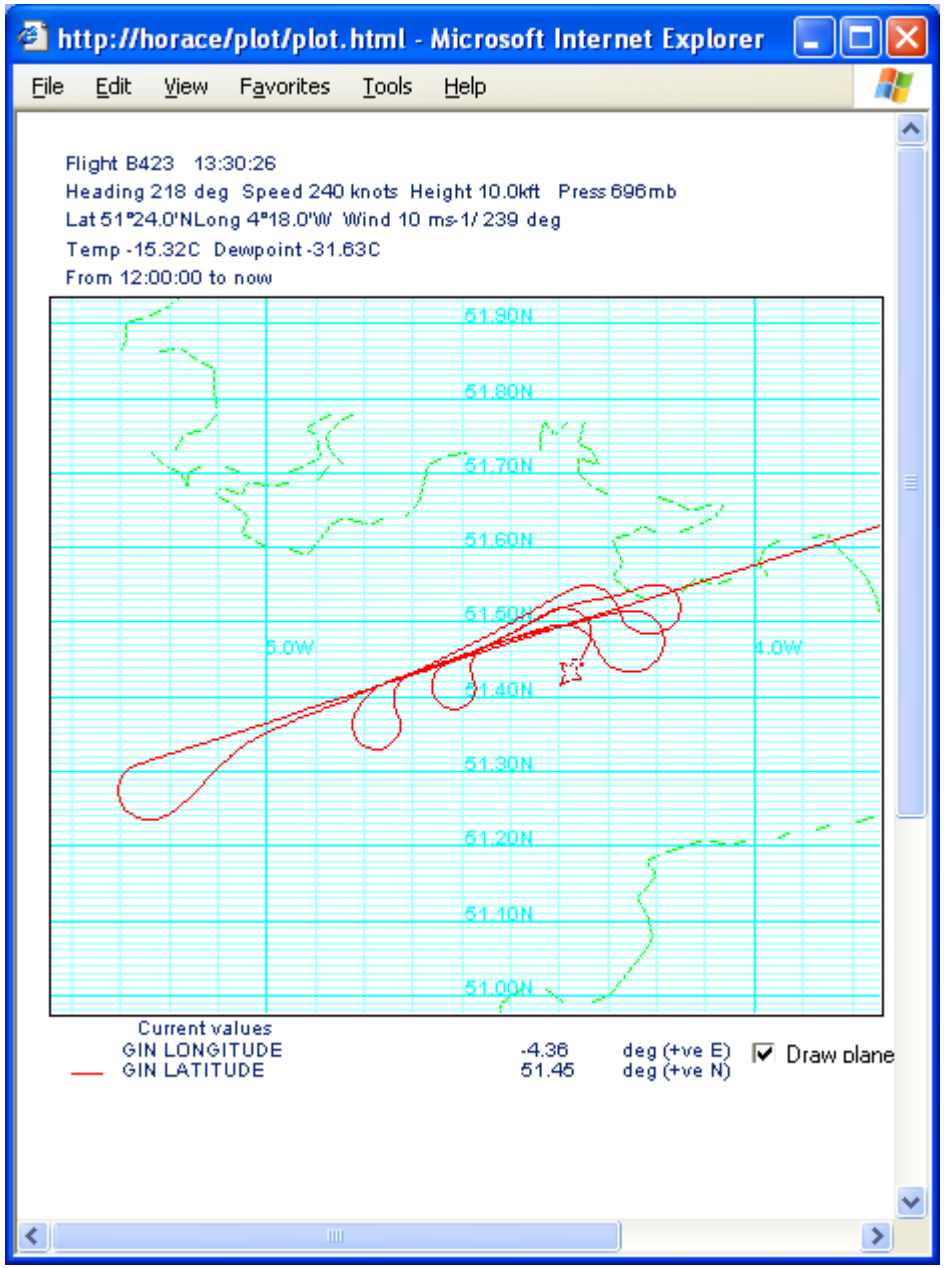
End P4 start R5 at FL120





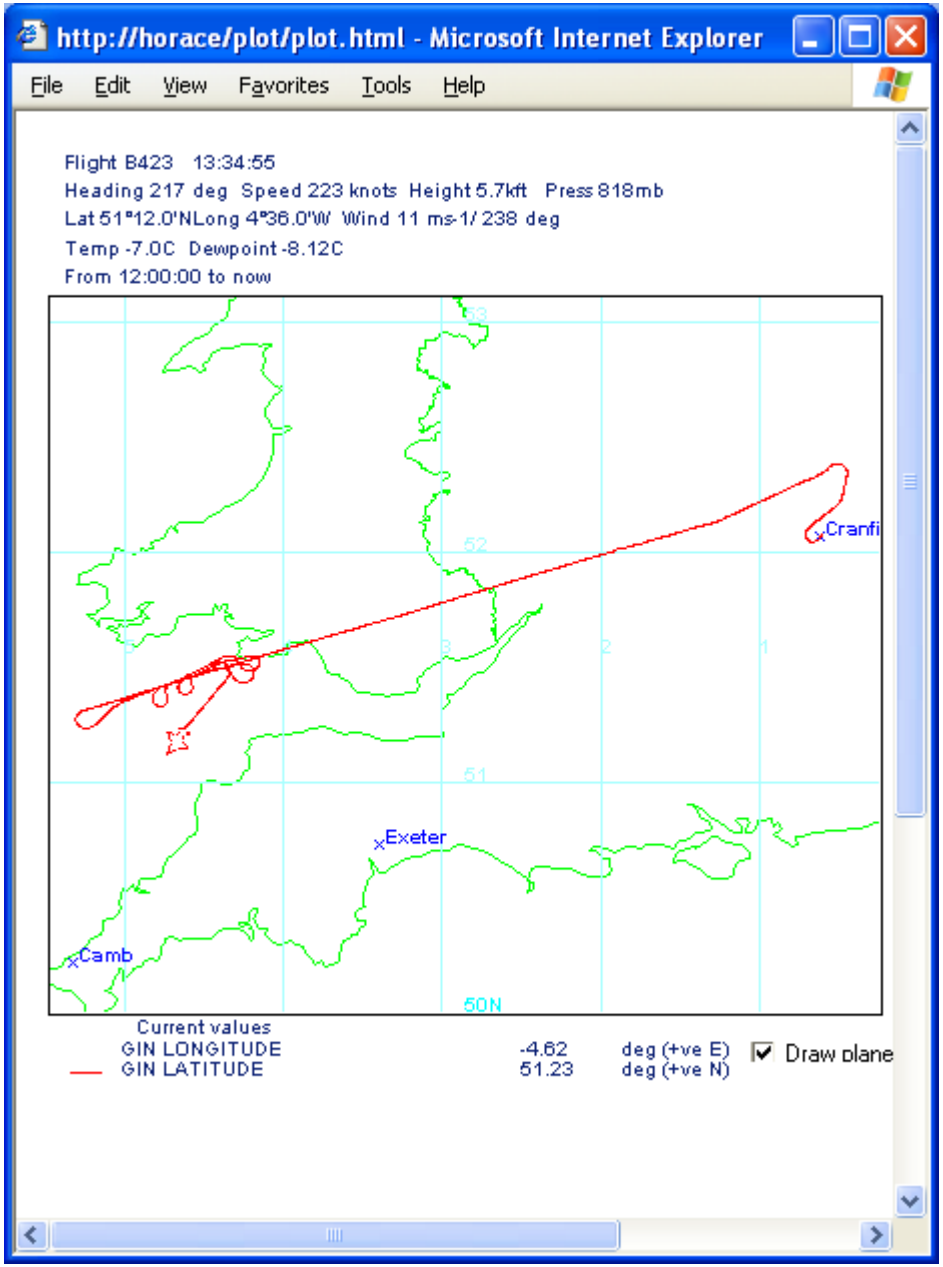
End R5 start P5

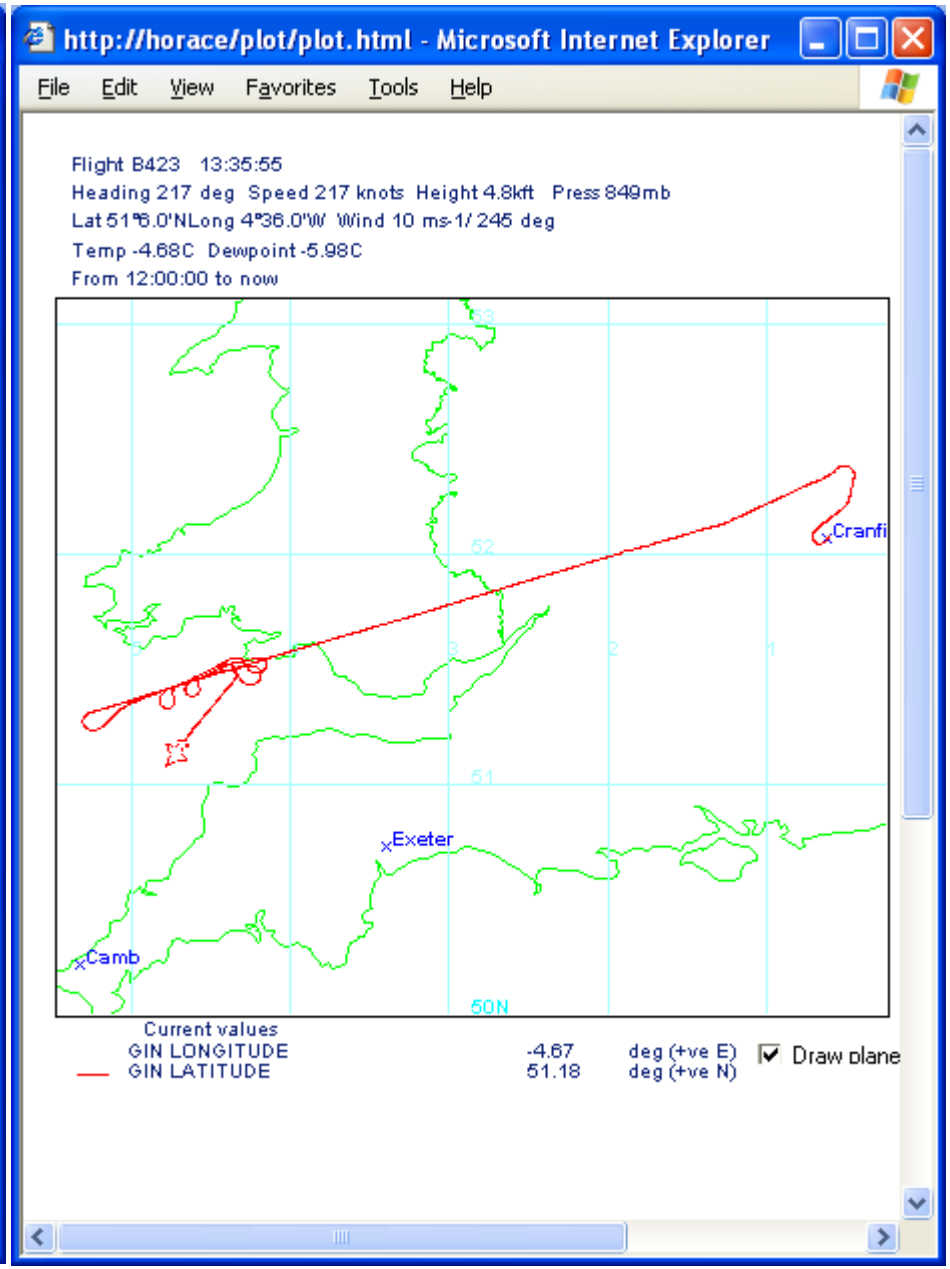




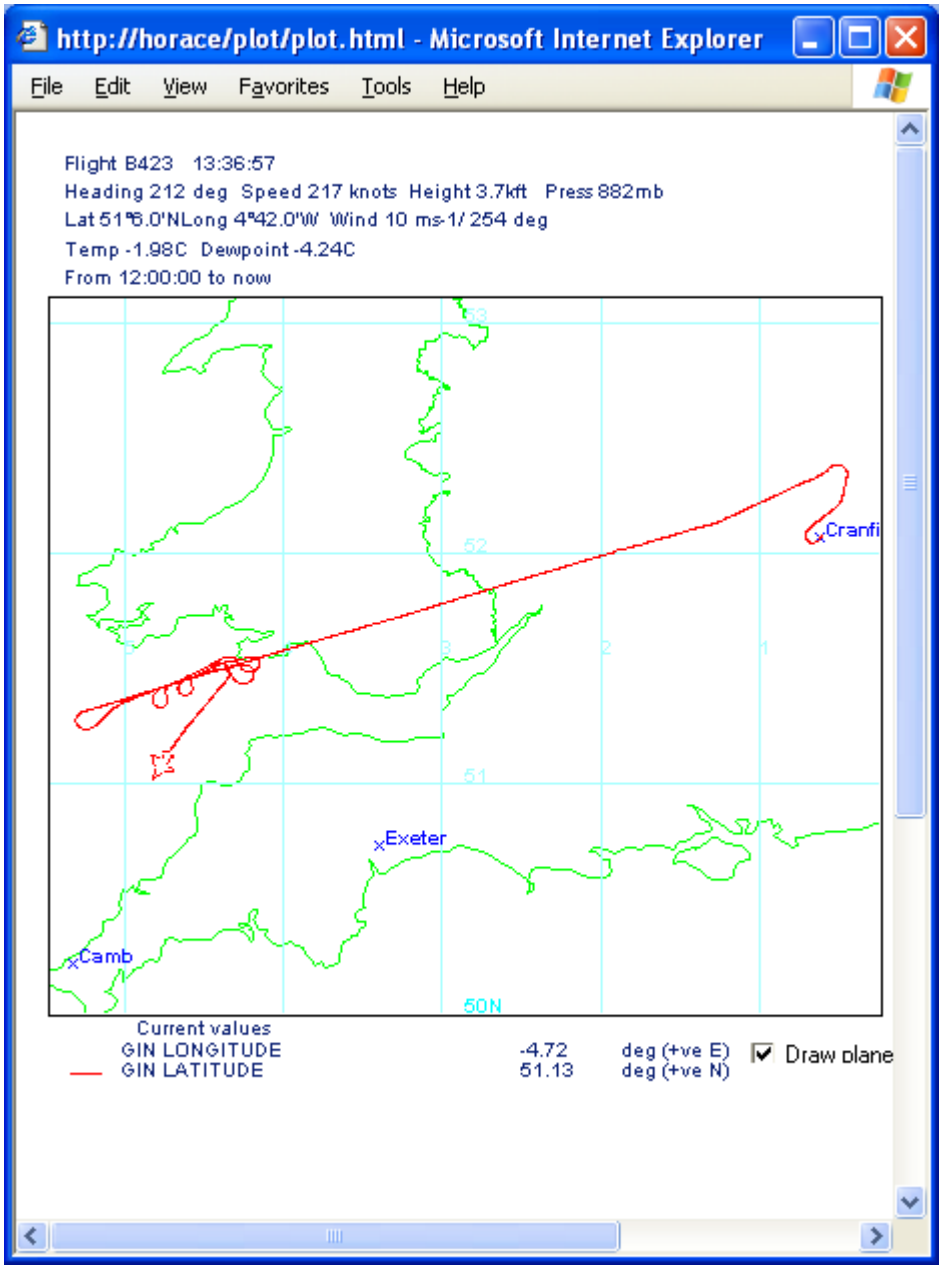
End P5 start R6

End R6 start P6 down to 1000ft

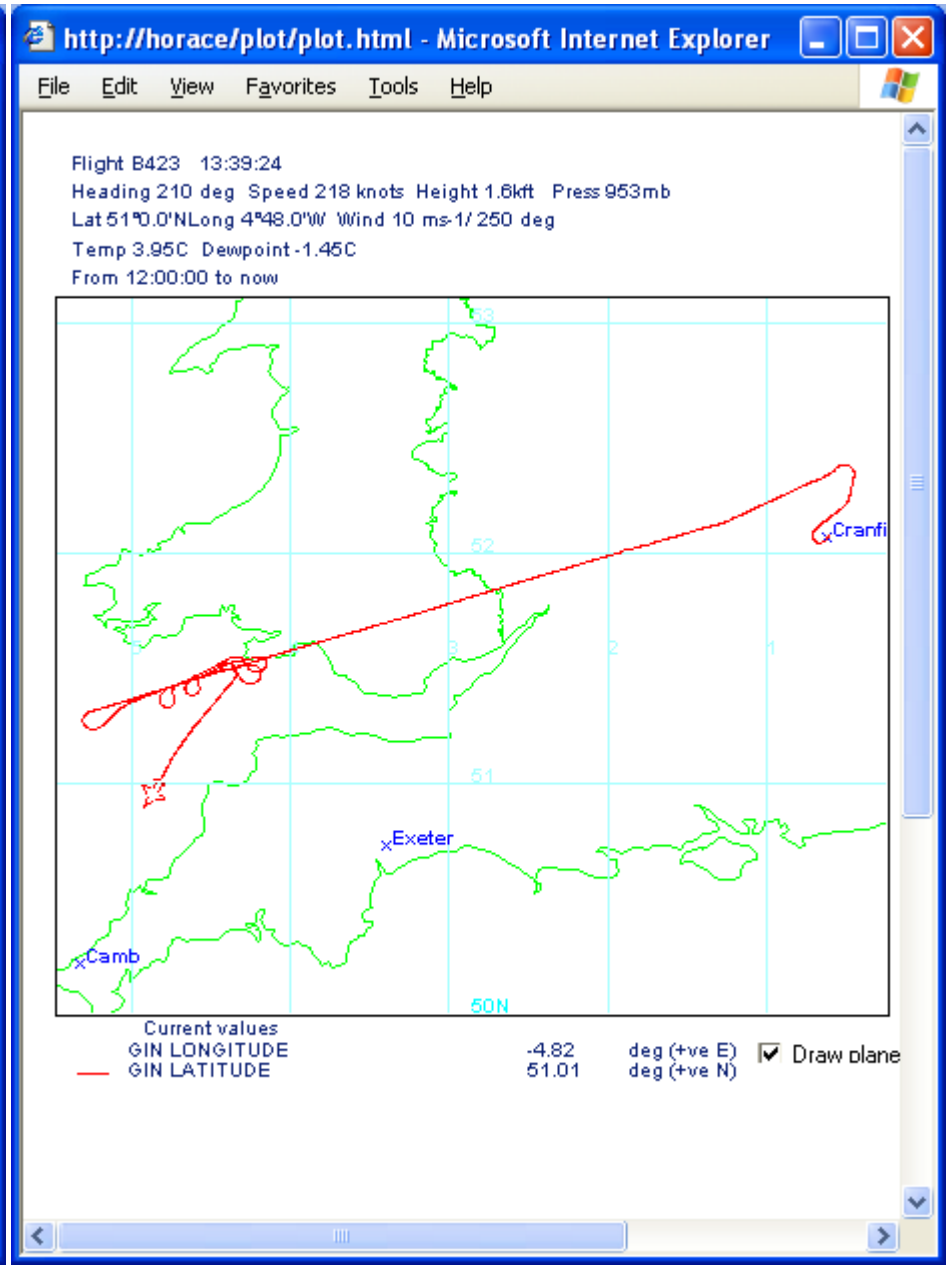




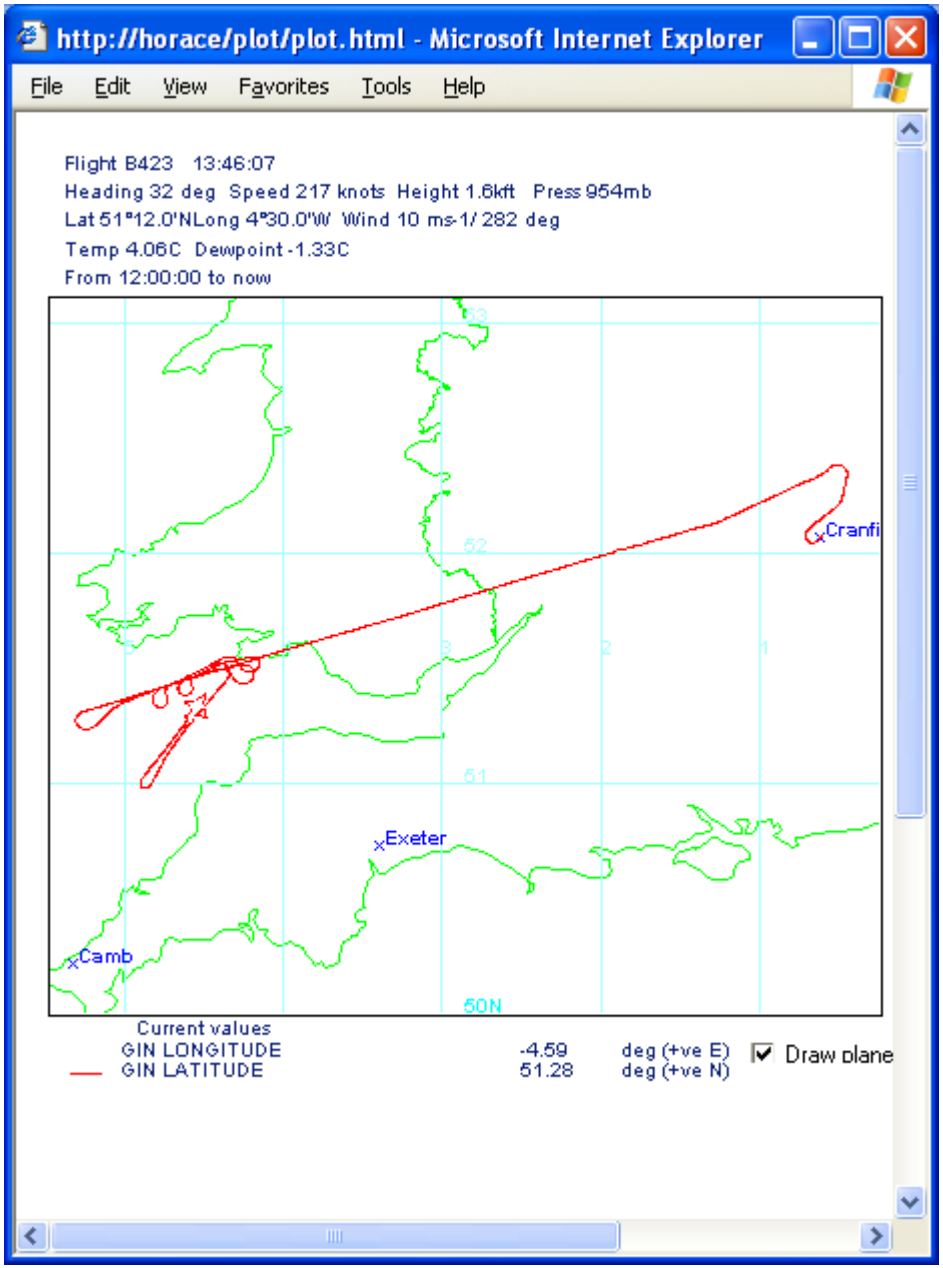
Entering cloud – still P6



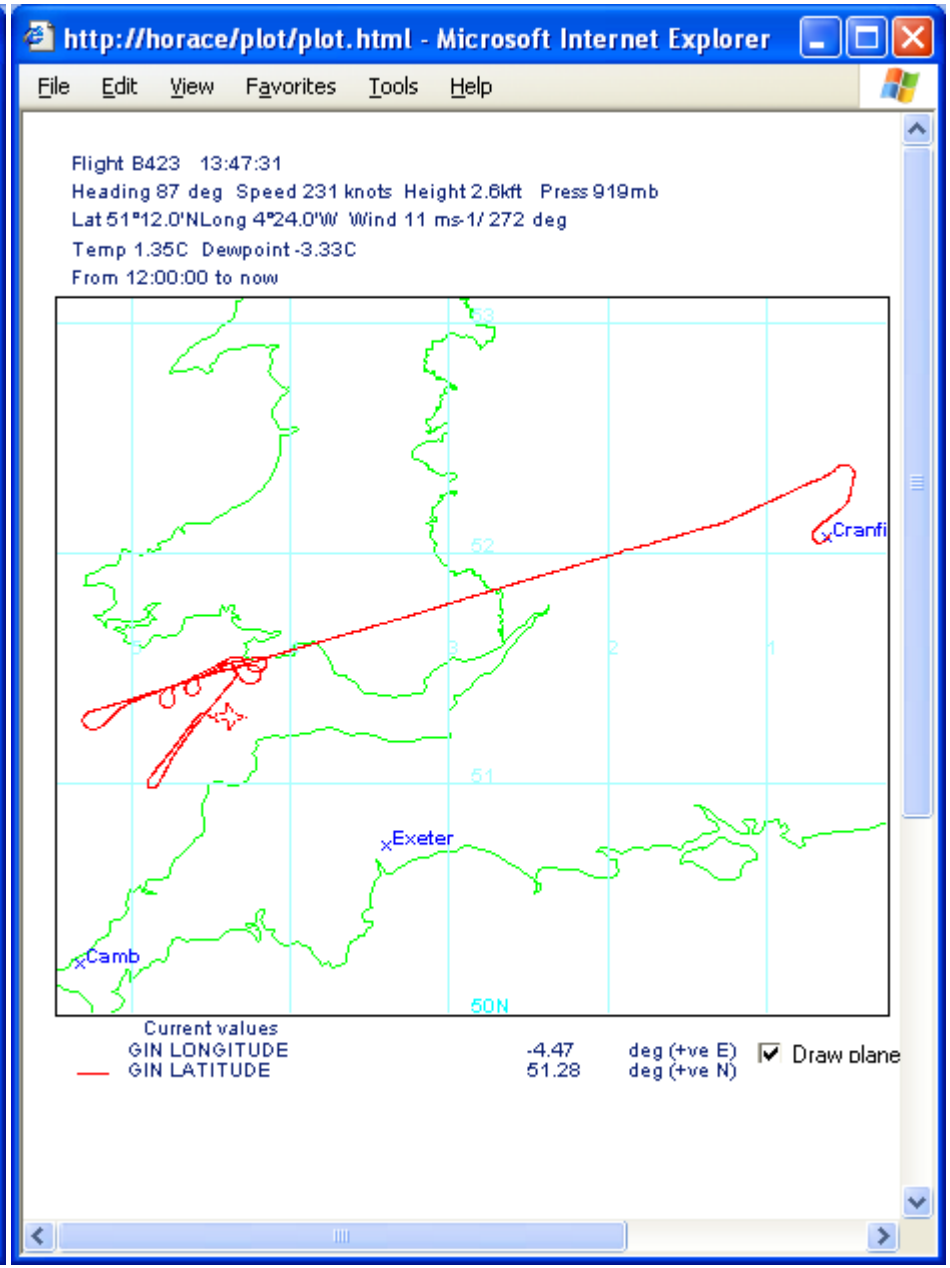
Out of cloud



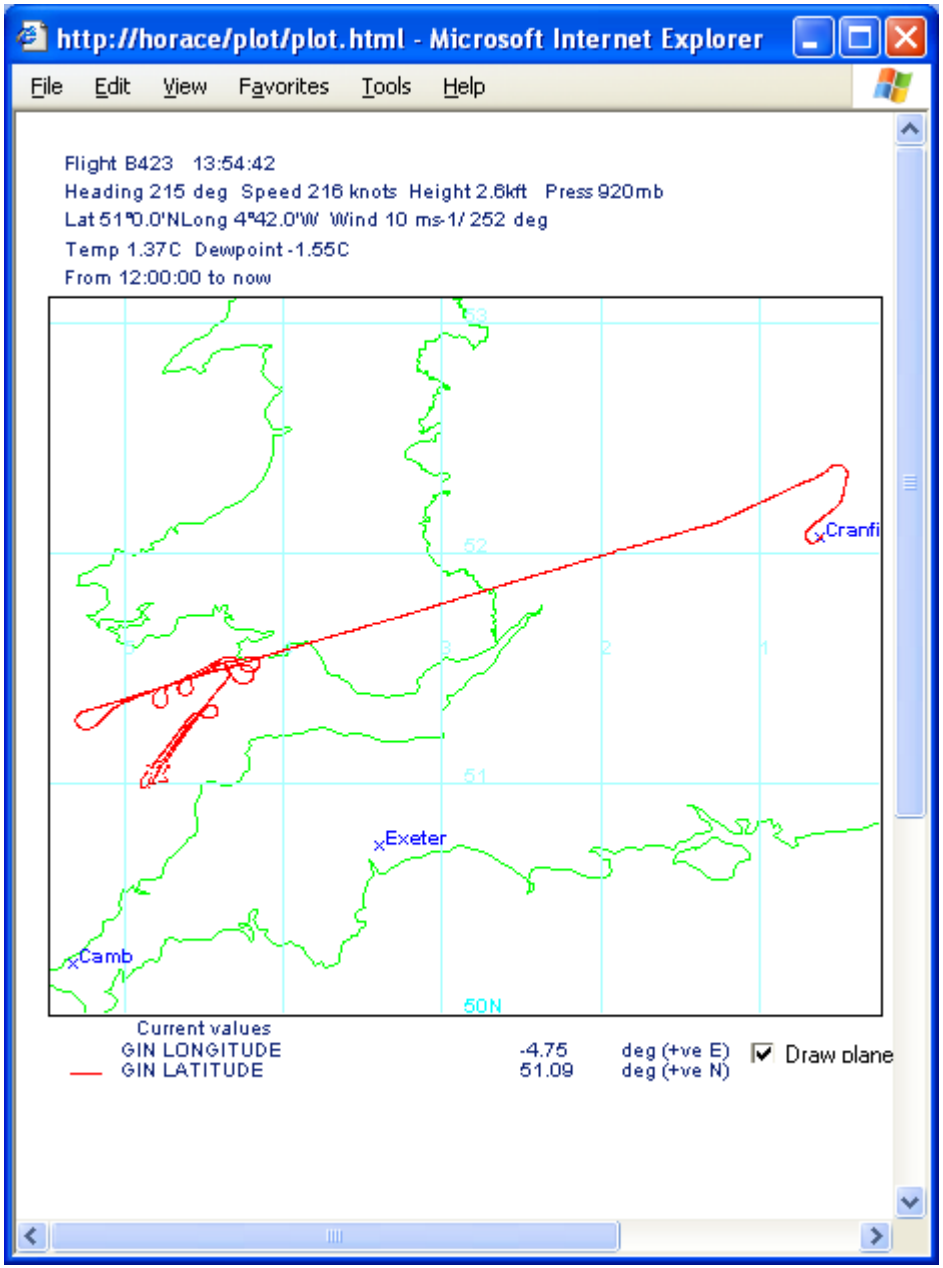
End P6 at 1000ft on 990mb



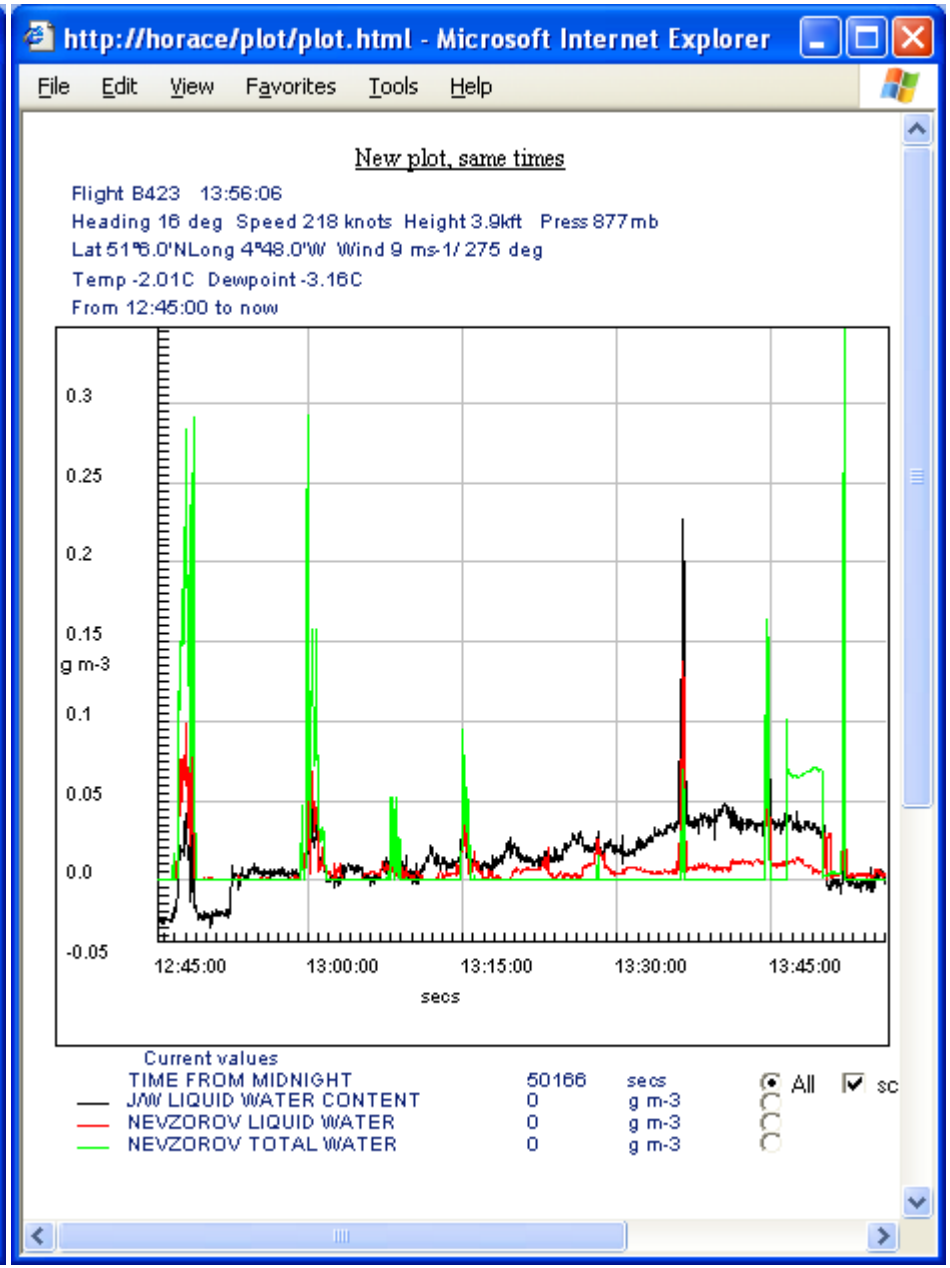
End R7 start P7 at 1000ft



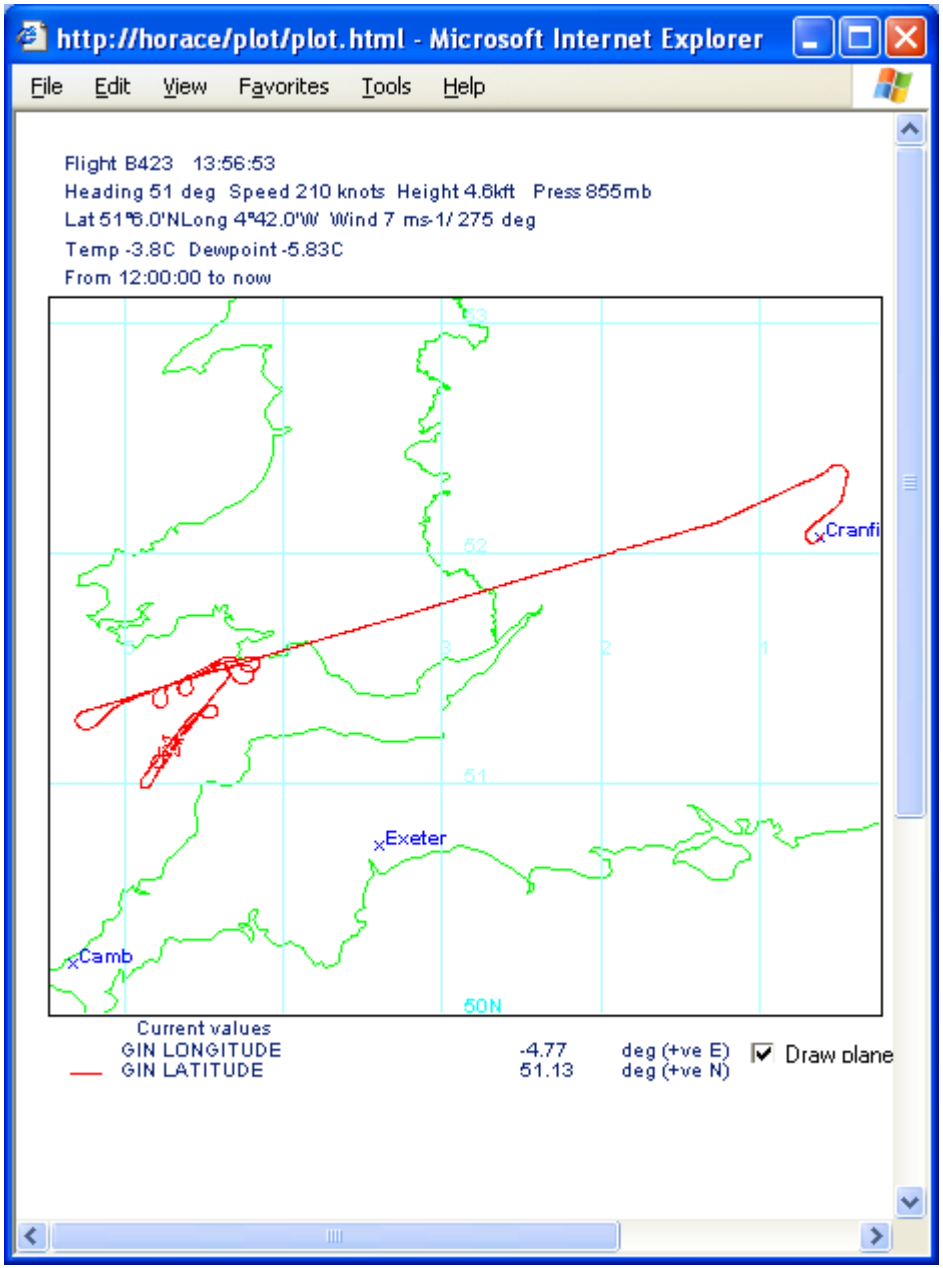
End P7 start R8 at 2000ft

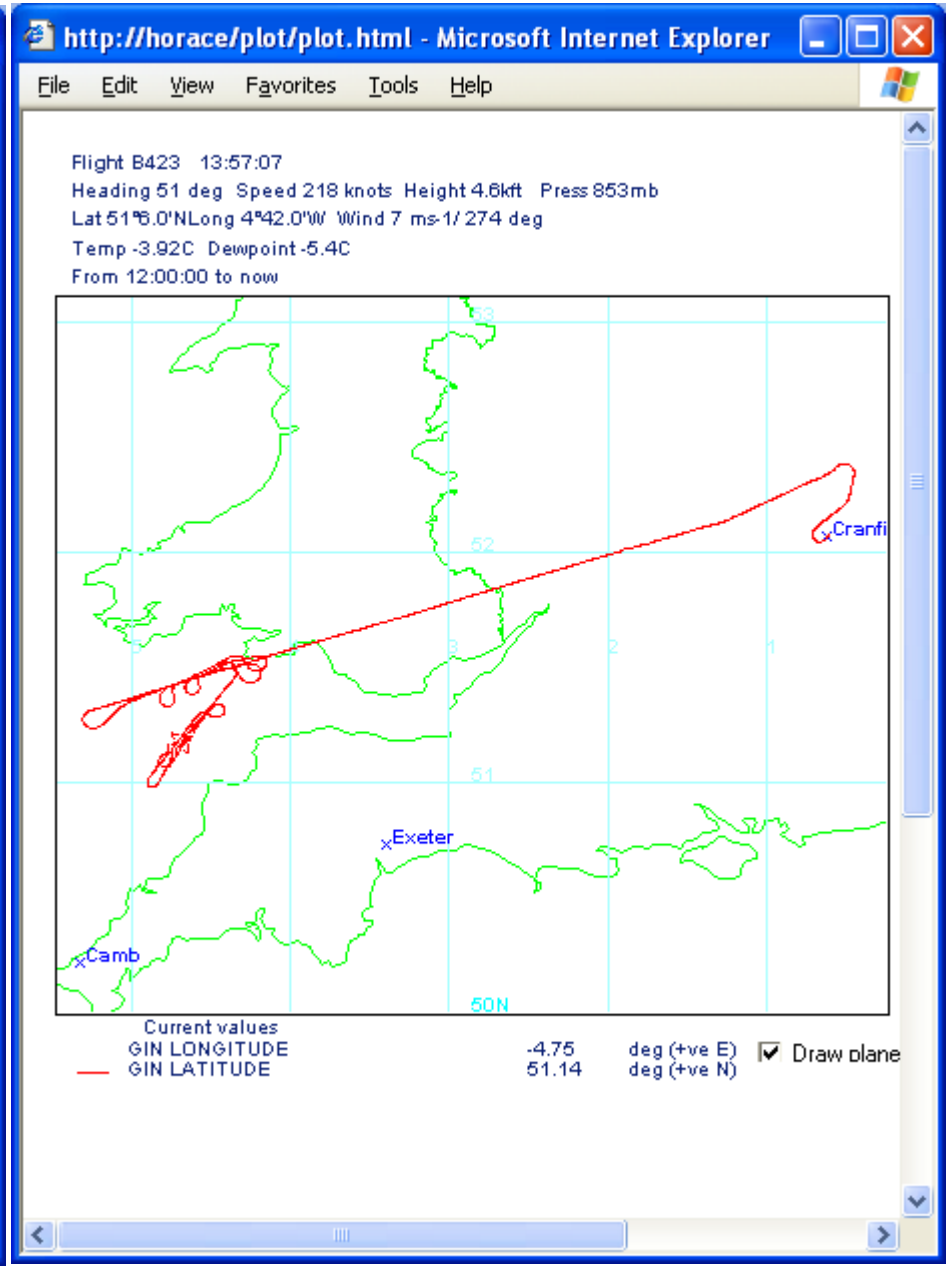


End R8 start P8



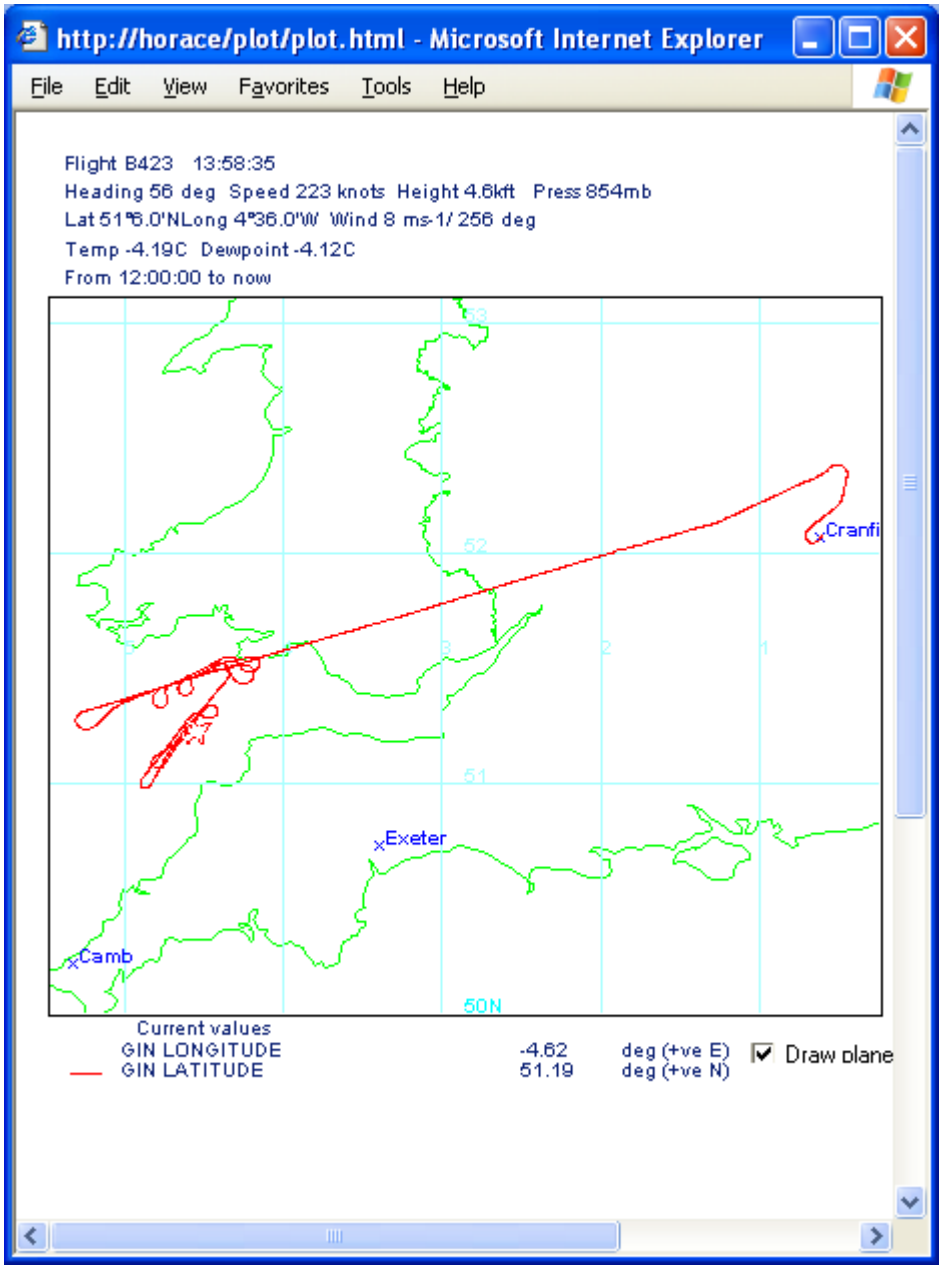
Water in each older turret pass



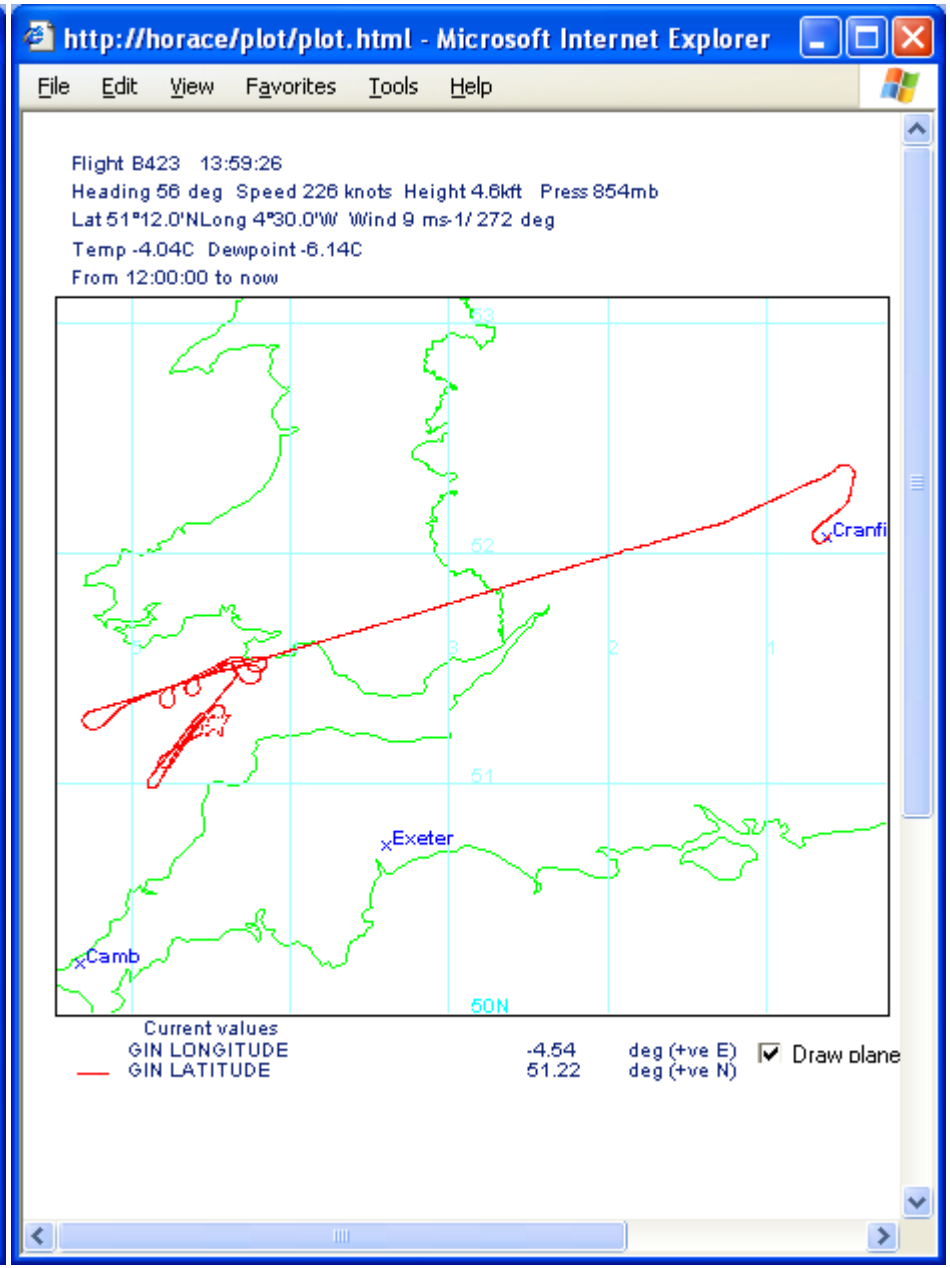


End P8 start R9 4000ft

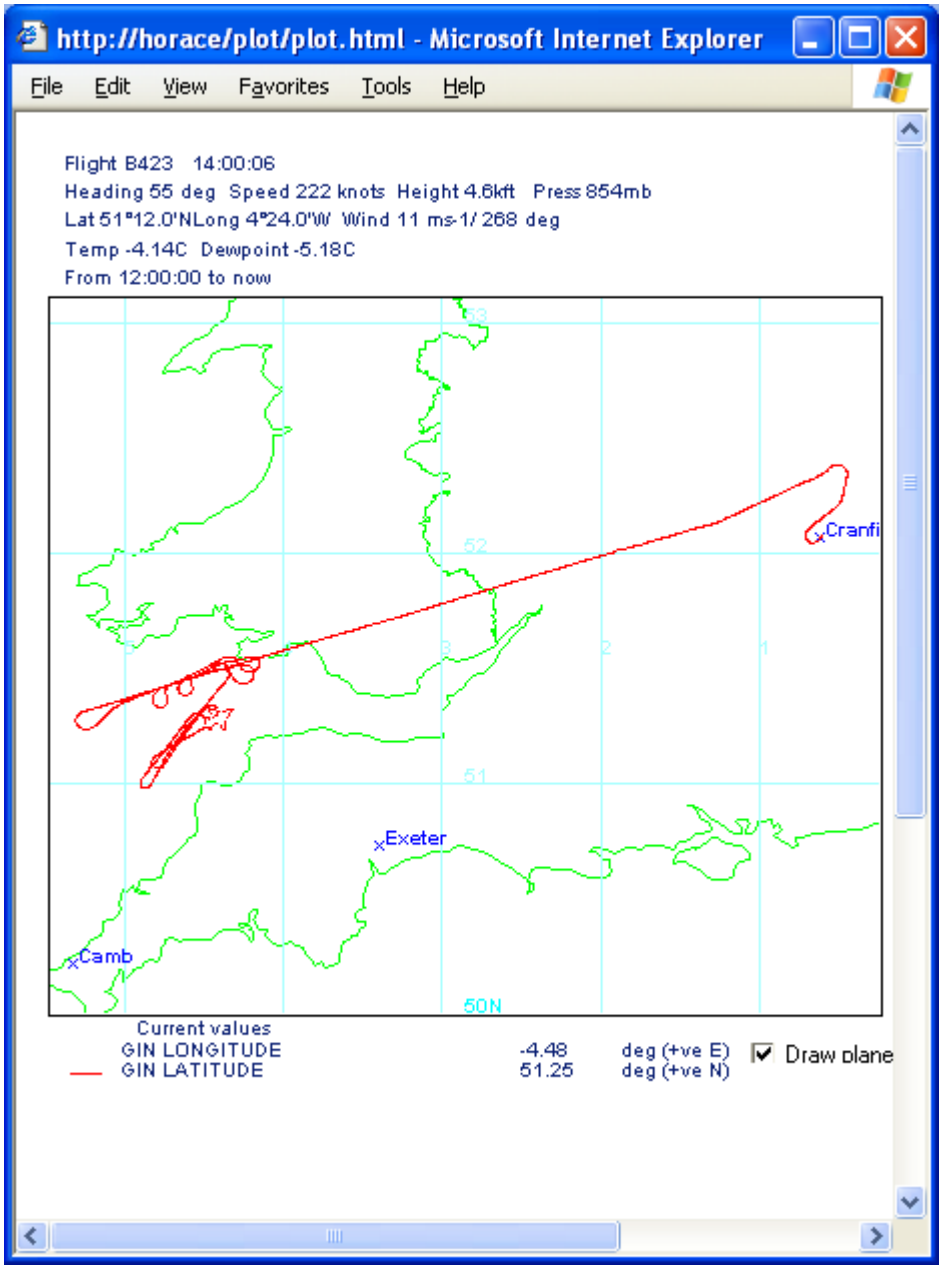
bumpy



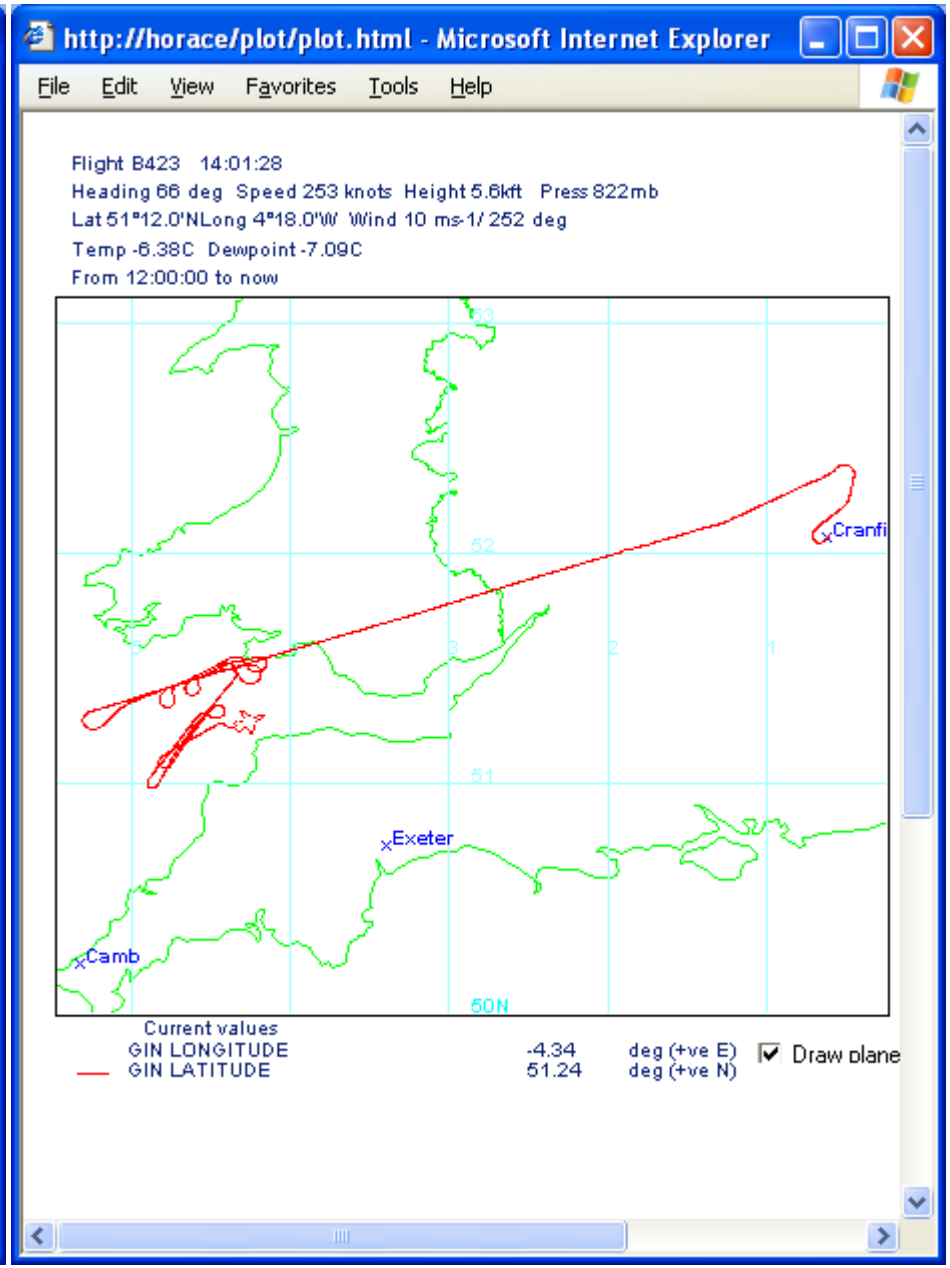
Cloud R9



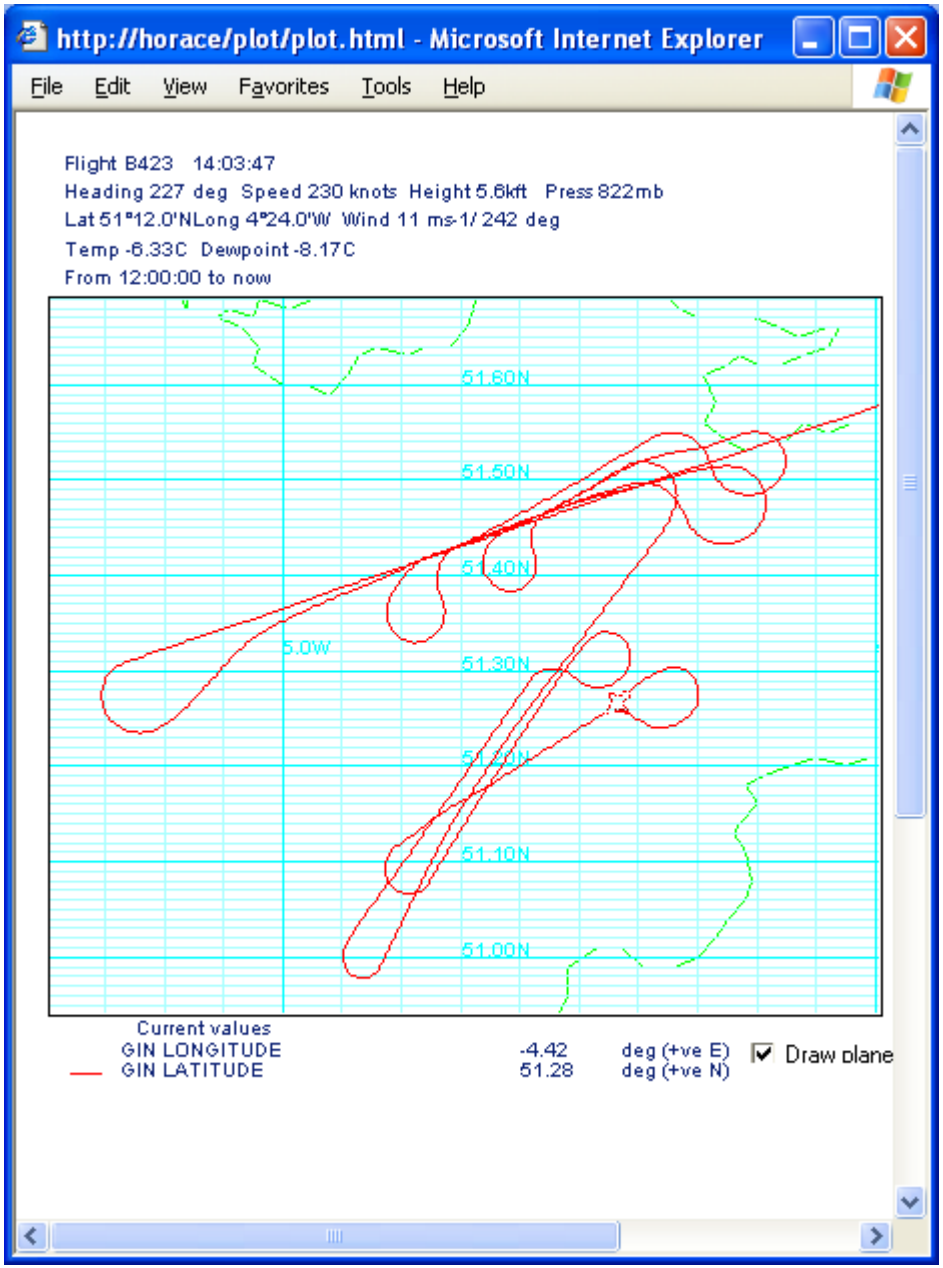
Out of cloud R9

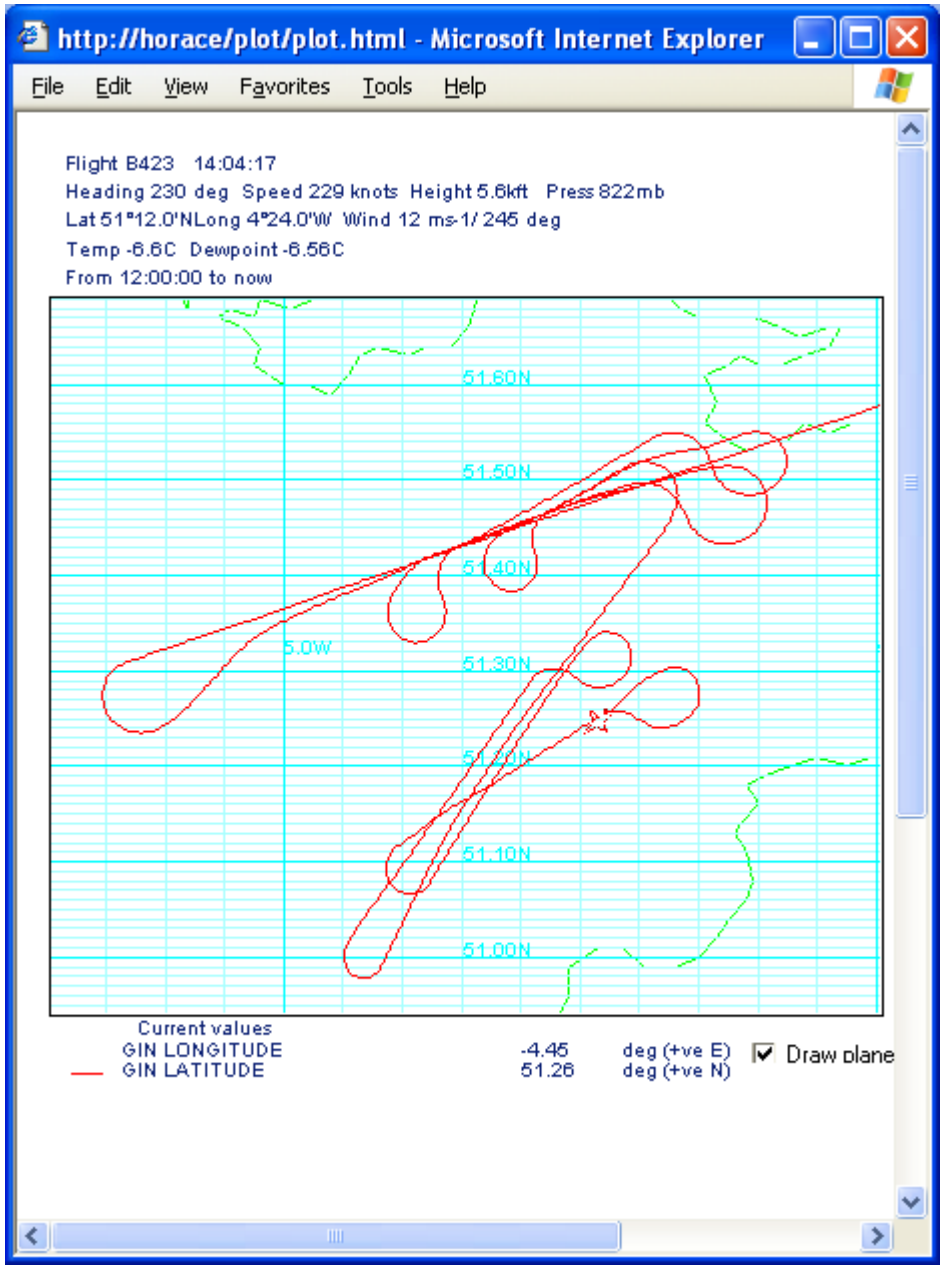


End R9 start P9 at 4000ft

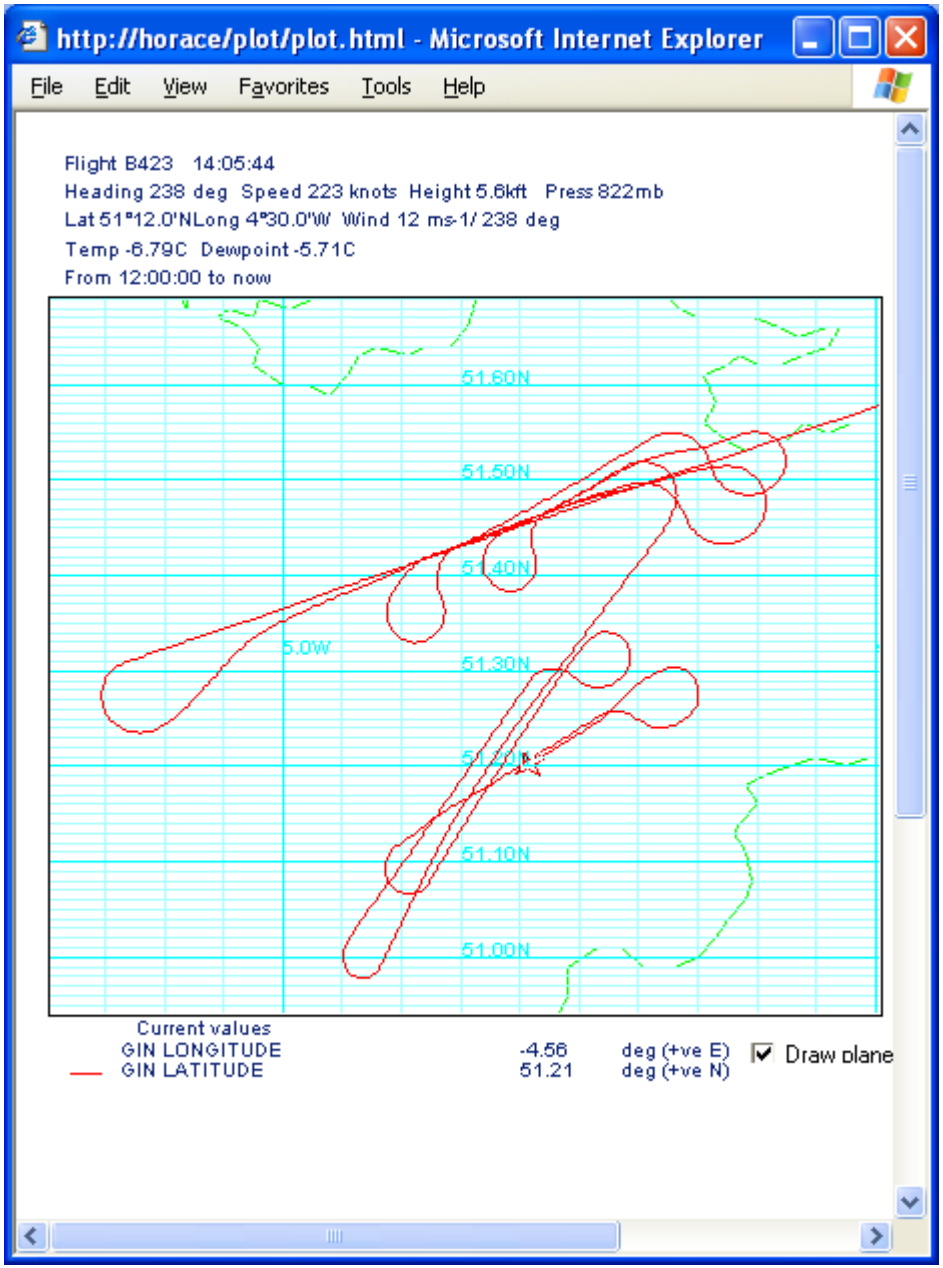


End P9 start R10 at 5000ft

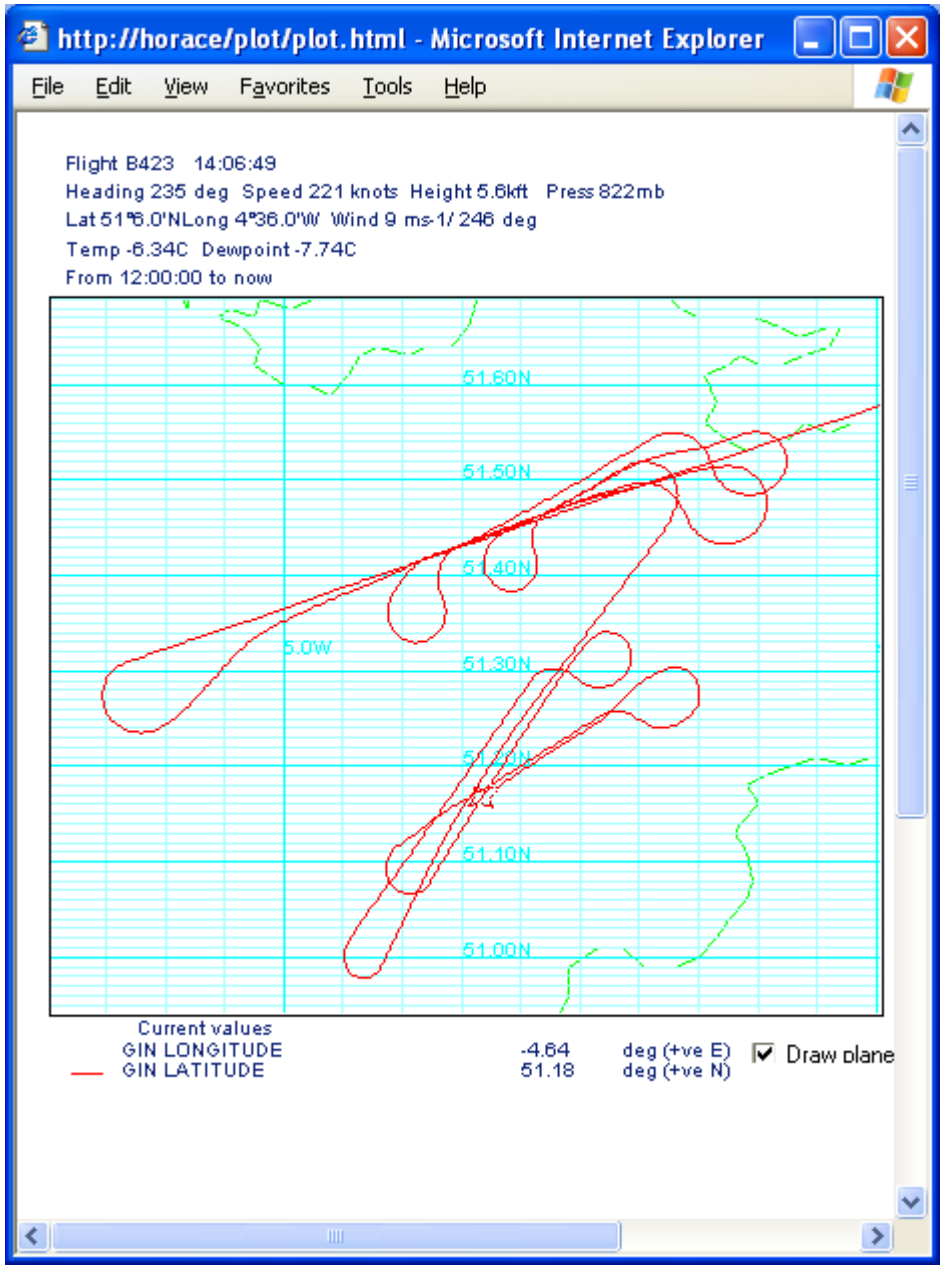

http://horace/plot/plot.html - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Flight B423 14:03:47
Heading 227 deg Speed 230 knots Height 5.6kft Press 822mb
Lat 51°12.0'N Long 4°24.0'W Wind 11 ms-1/ 242 deg
Temp -6.33C Dewpoint -8.17C
From 12:00:00 to now
51.60N
51.50N
51.40N
5.0W
51.30N
51.10N
51.00N
Current values
GIN LONGITUDE -4.42 deg (+ve E)
GIN LATITUDE 51.28 deg (+ve N)
Draw plane


http://horace/plot/plot.html - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Flight B423 14:04:17
Heading 230 deg Speed 229 knots Height 5.6kft Press 822mb
Lat 51°12.0'N Long 4°24.0'W Wind 12 ms-1/ 245 deg
Temp -6.6C Dewpoint -6.56C
From 12:00:00 to now
51.60N
51.50N
51.40N
5.0W
51.30N
51.10N
51.00N
Current values
GIN LONGITUDE -4.45 deg (+ve E)
GIN LATITUDE 51.26 deg (+ve N)
Draw plane

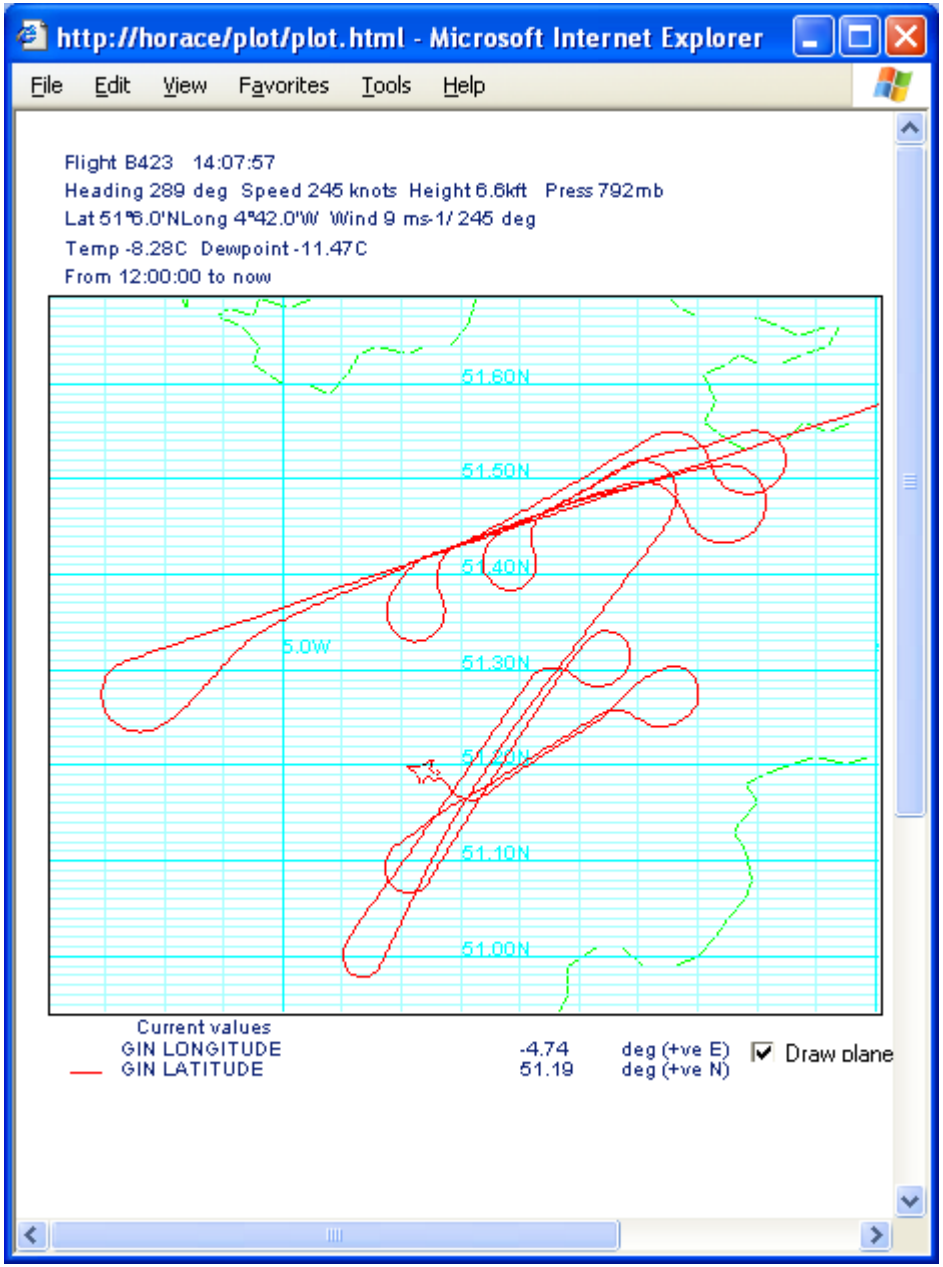
Cloud R10

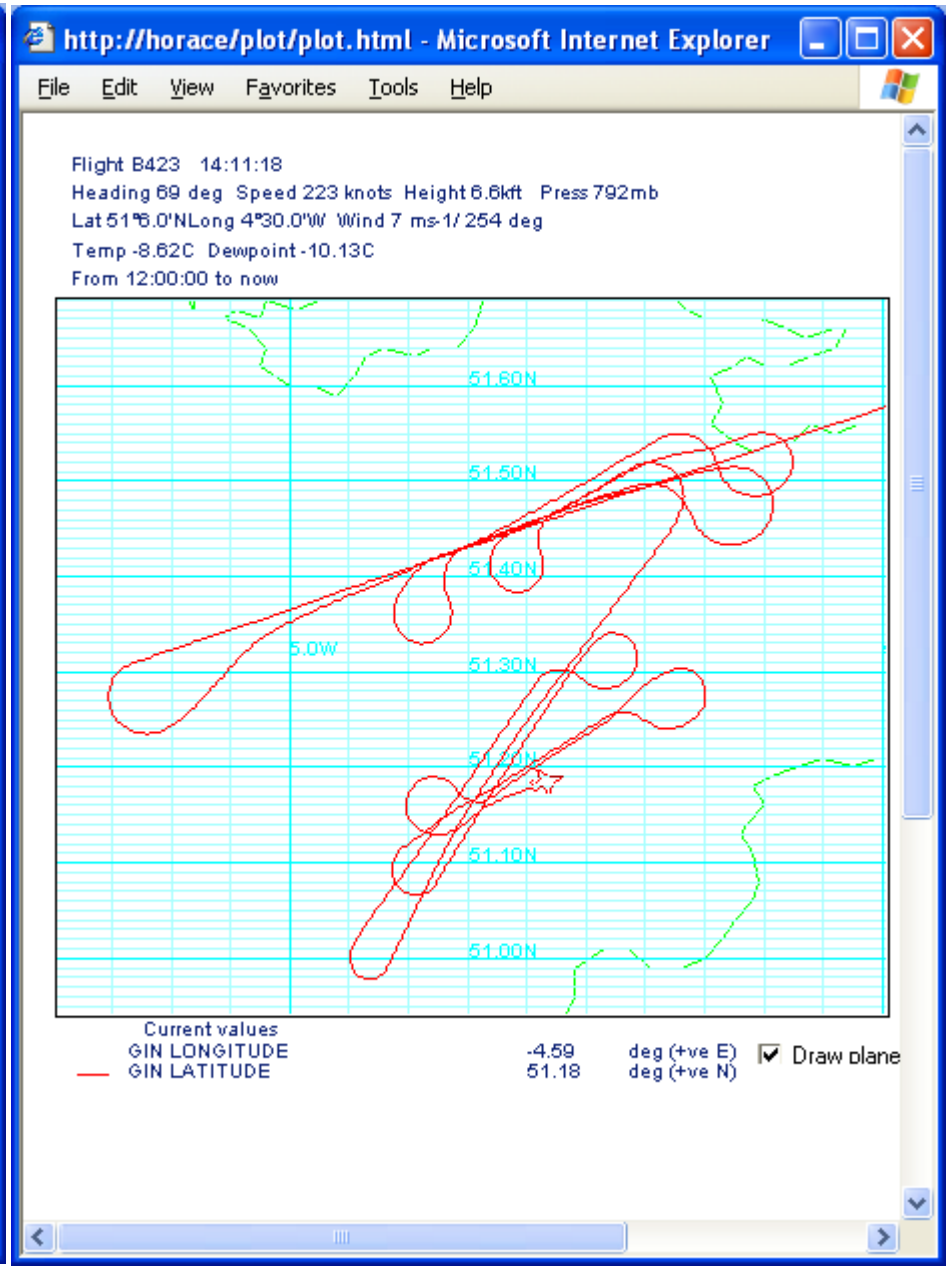


R10 clear of cloud



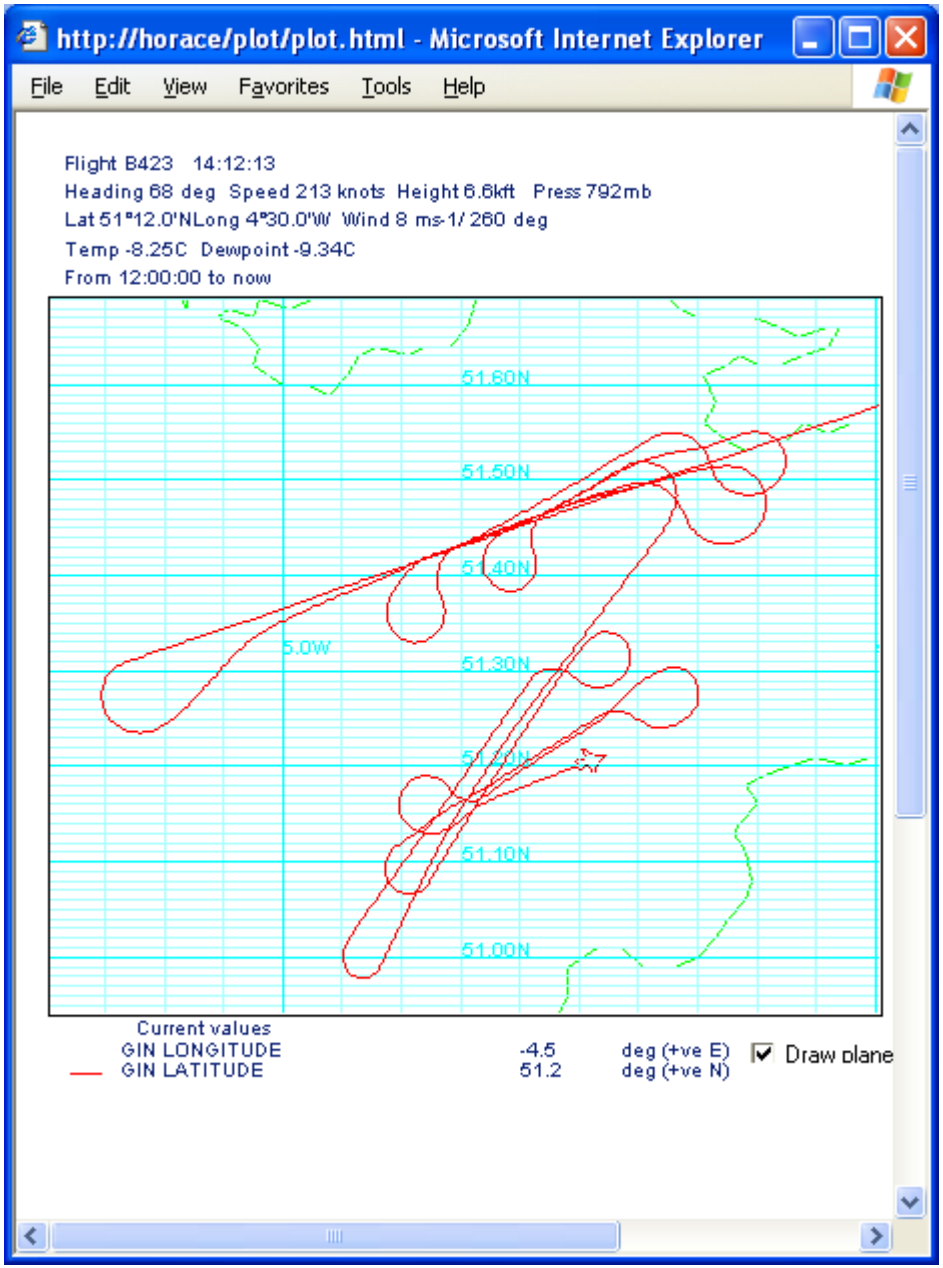
End R10 & start P10

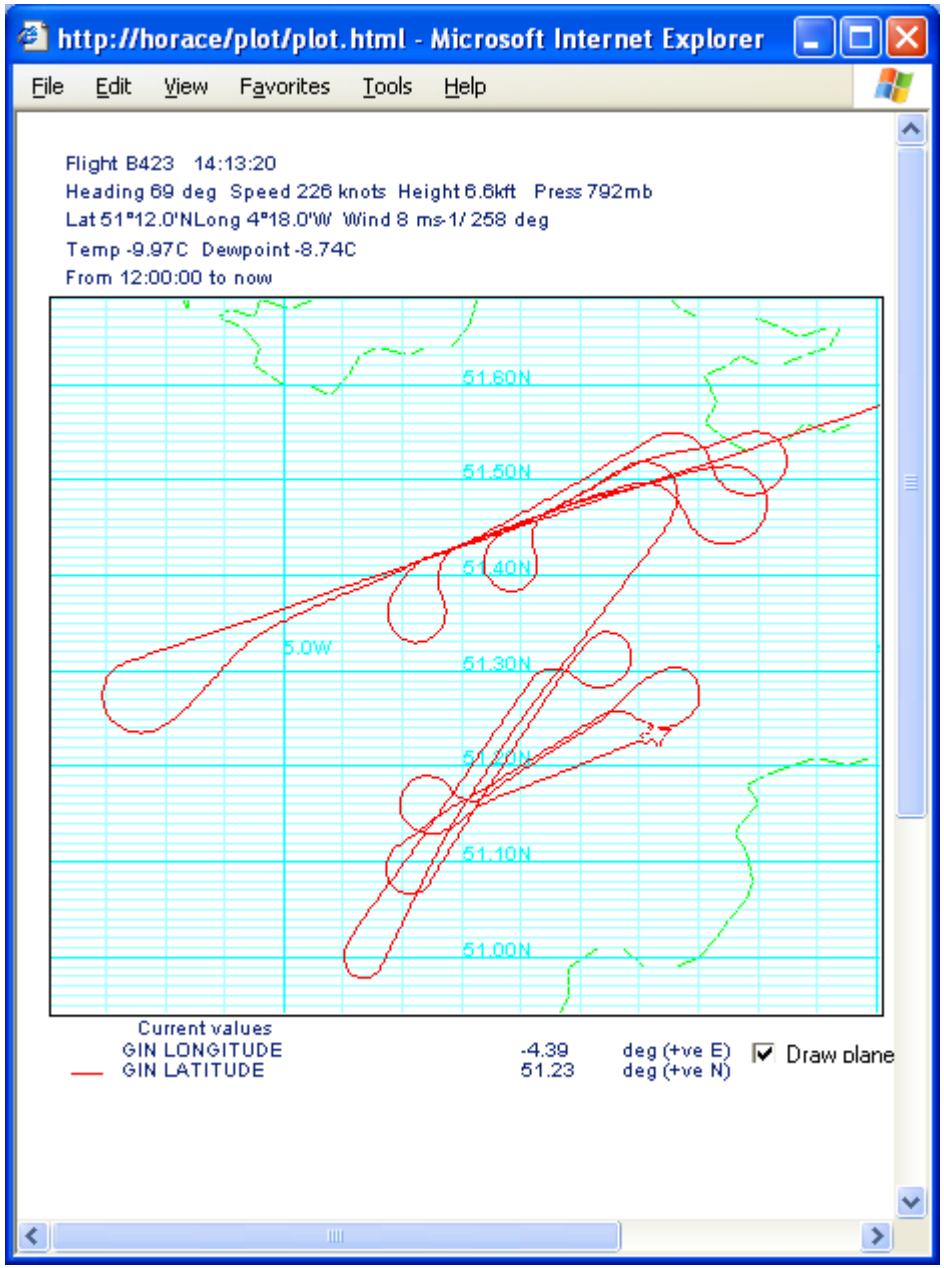




End P10 start R11 6000ft

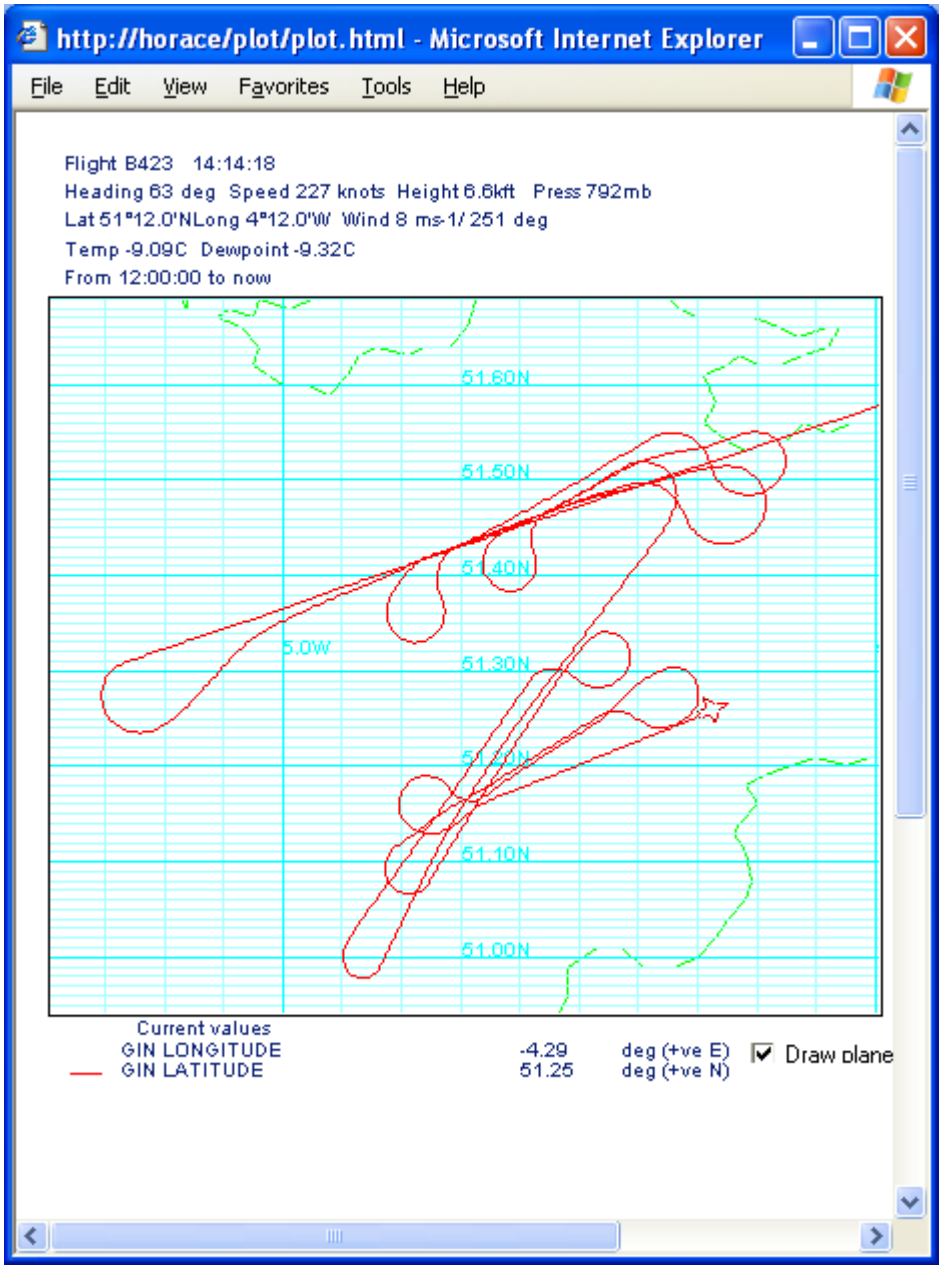
Cloud little one



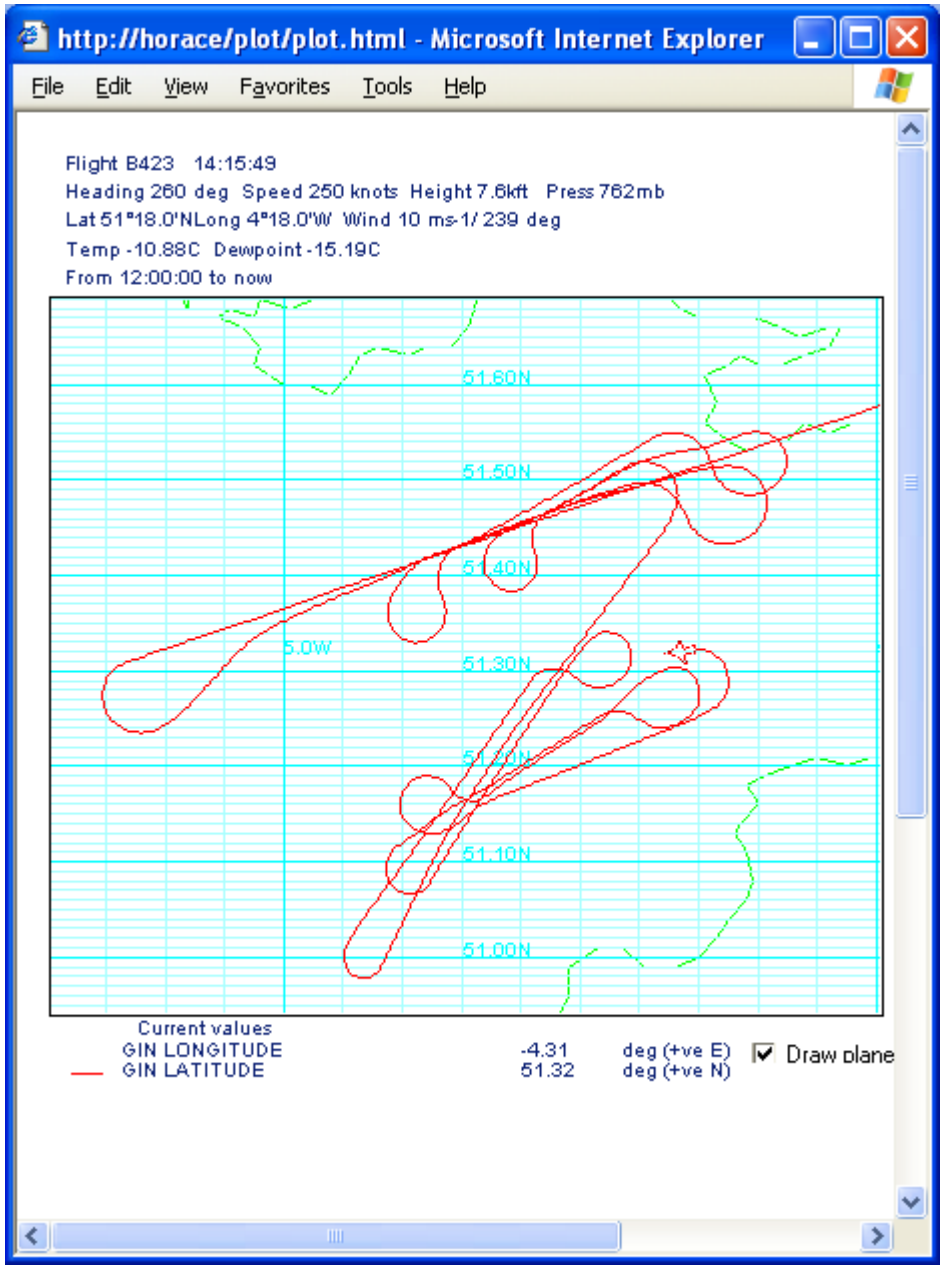


Bumpy - main cloud

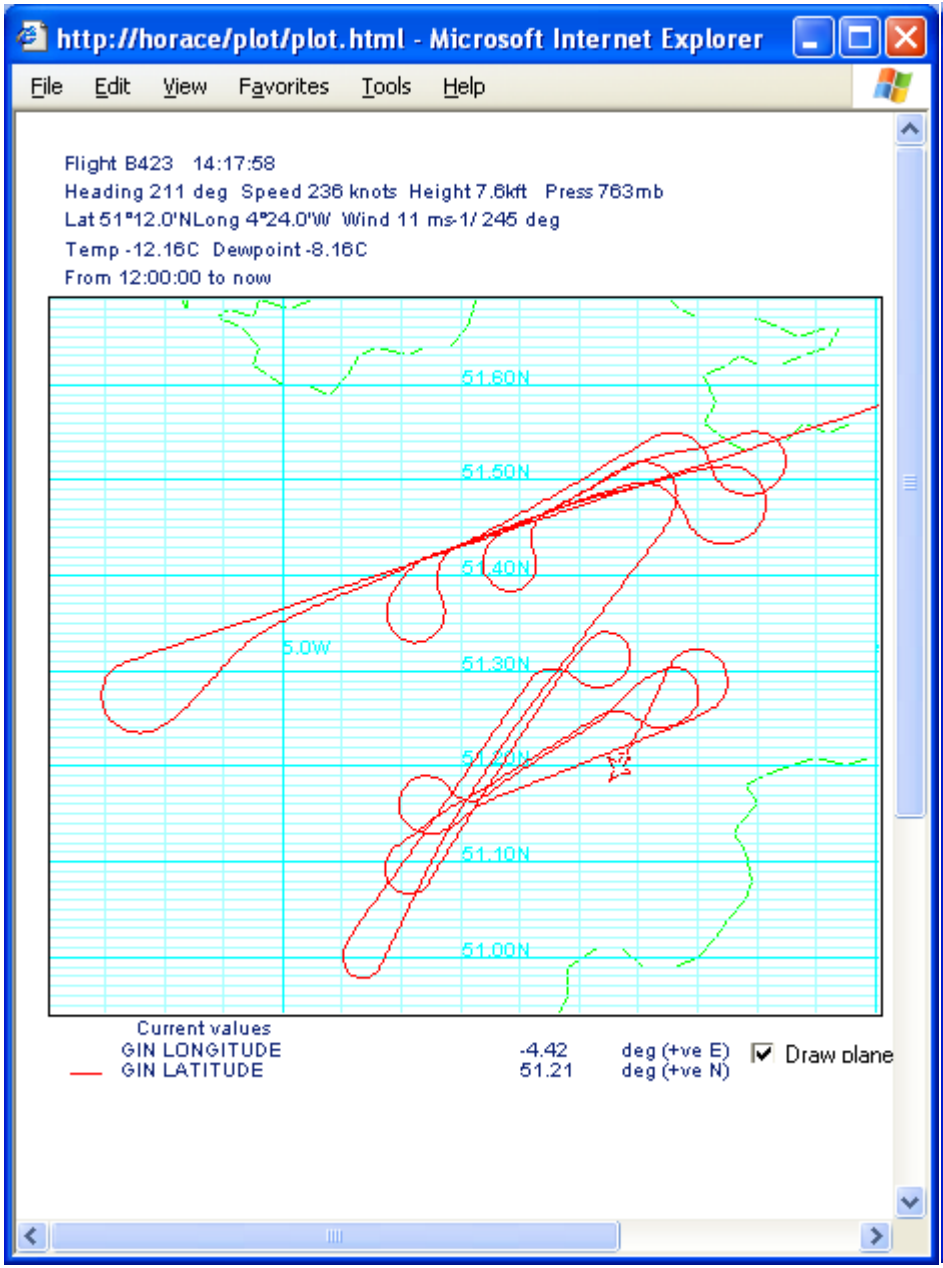
Out of cloud



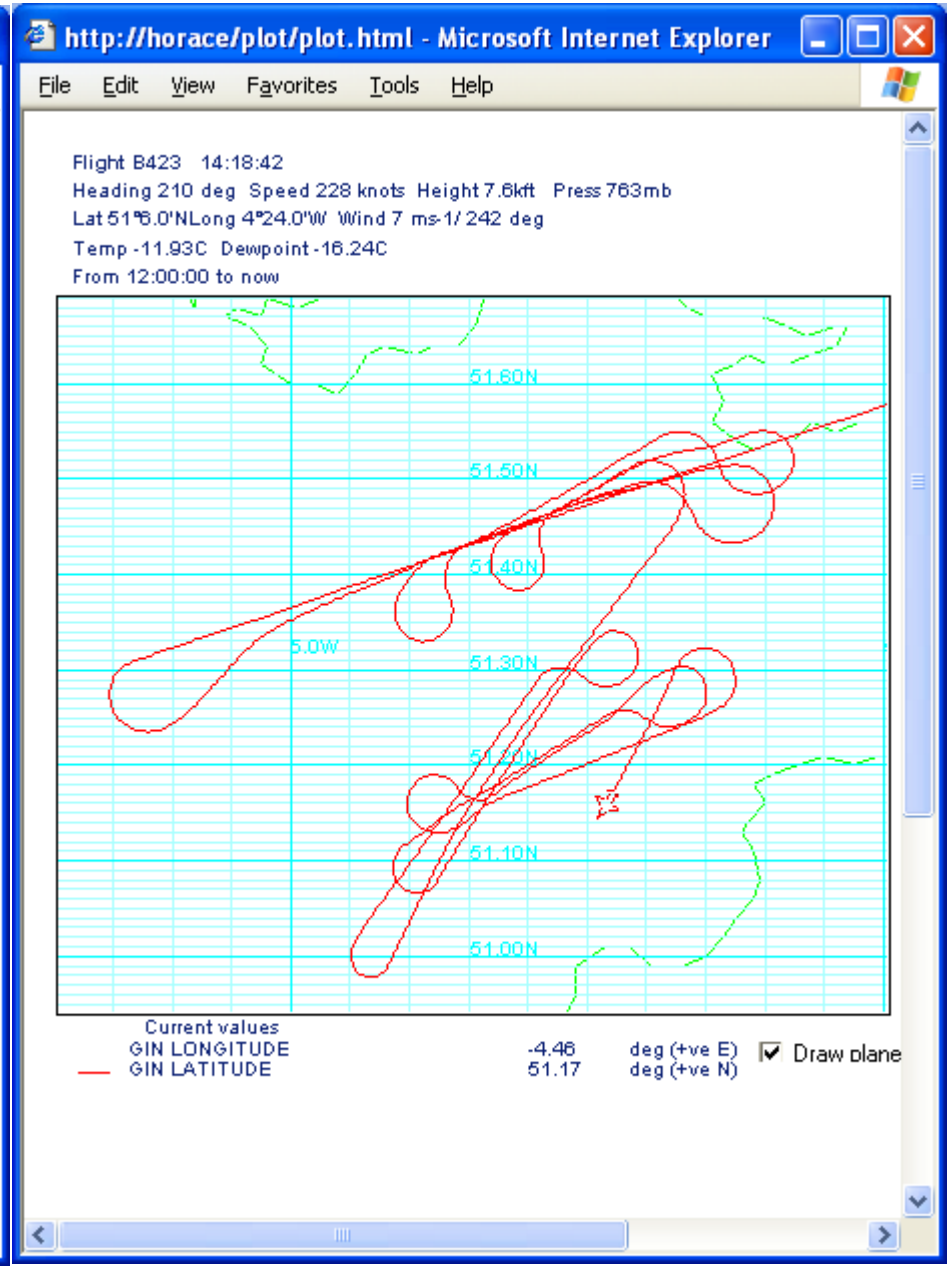
End R11 start P11 at 6000ft



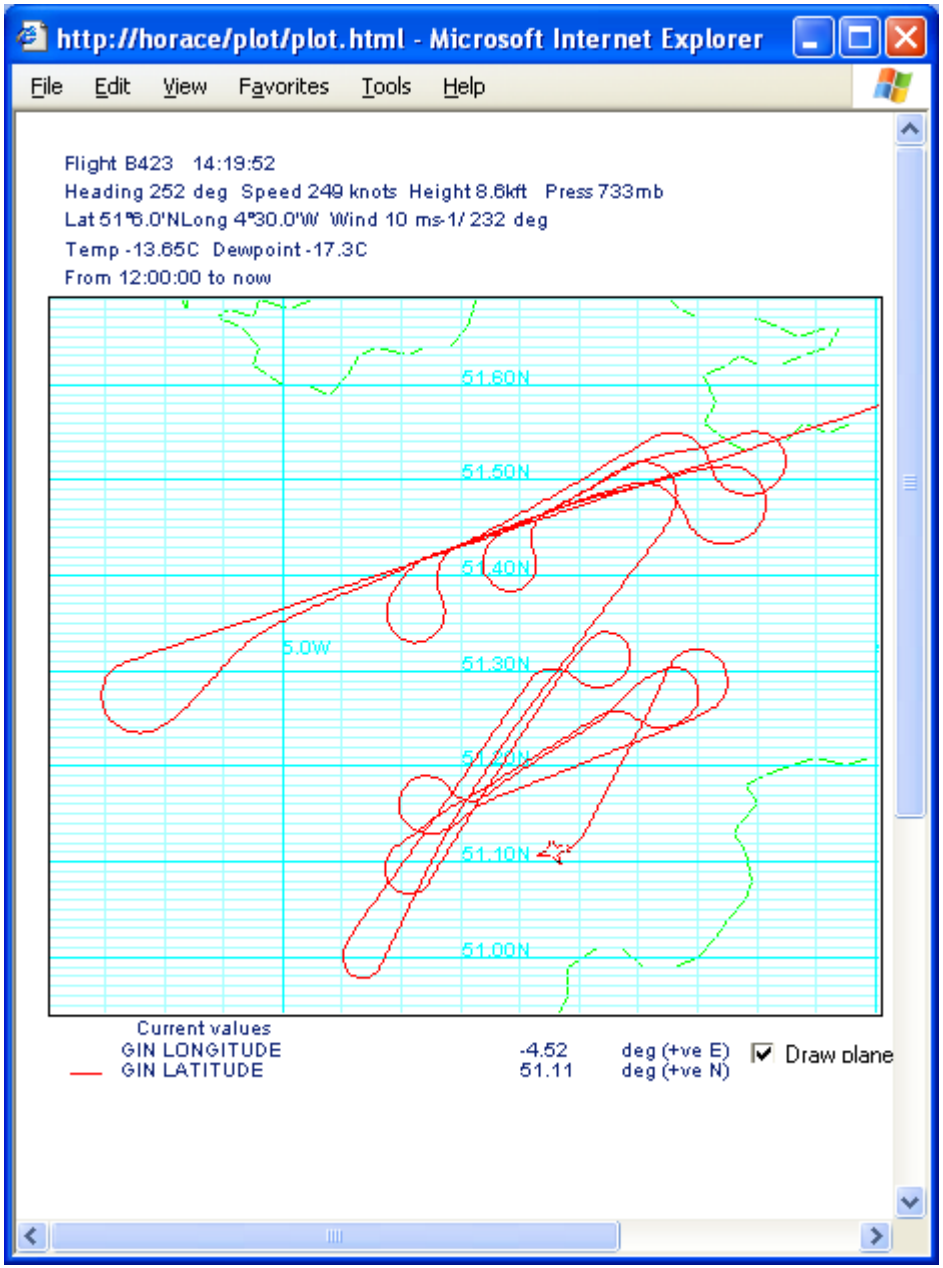
End P11 start R12 at 7000ft

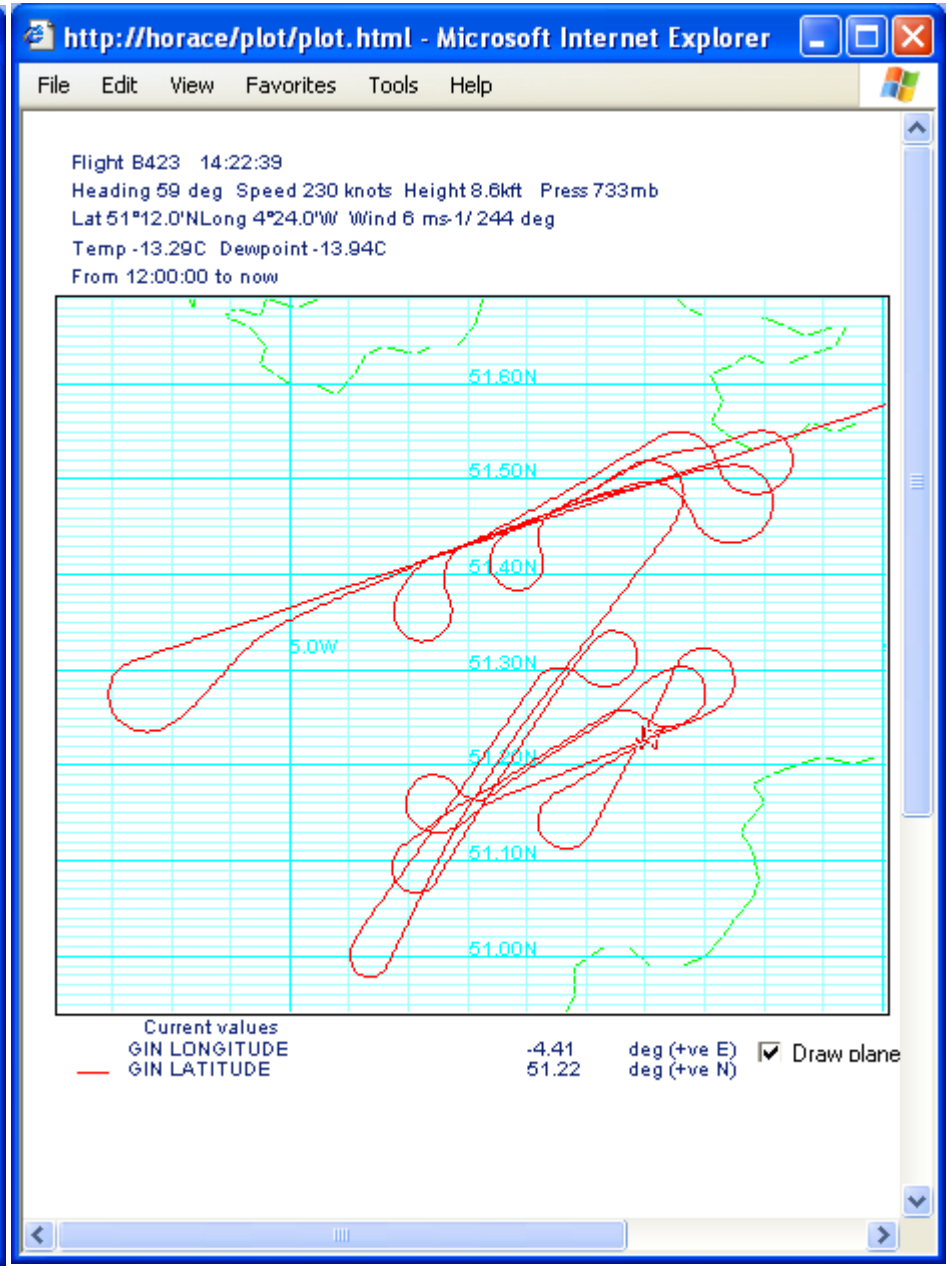


R12 Cloud



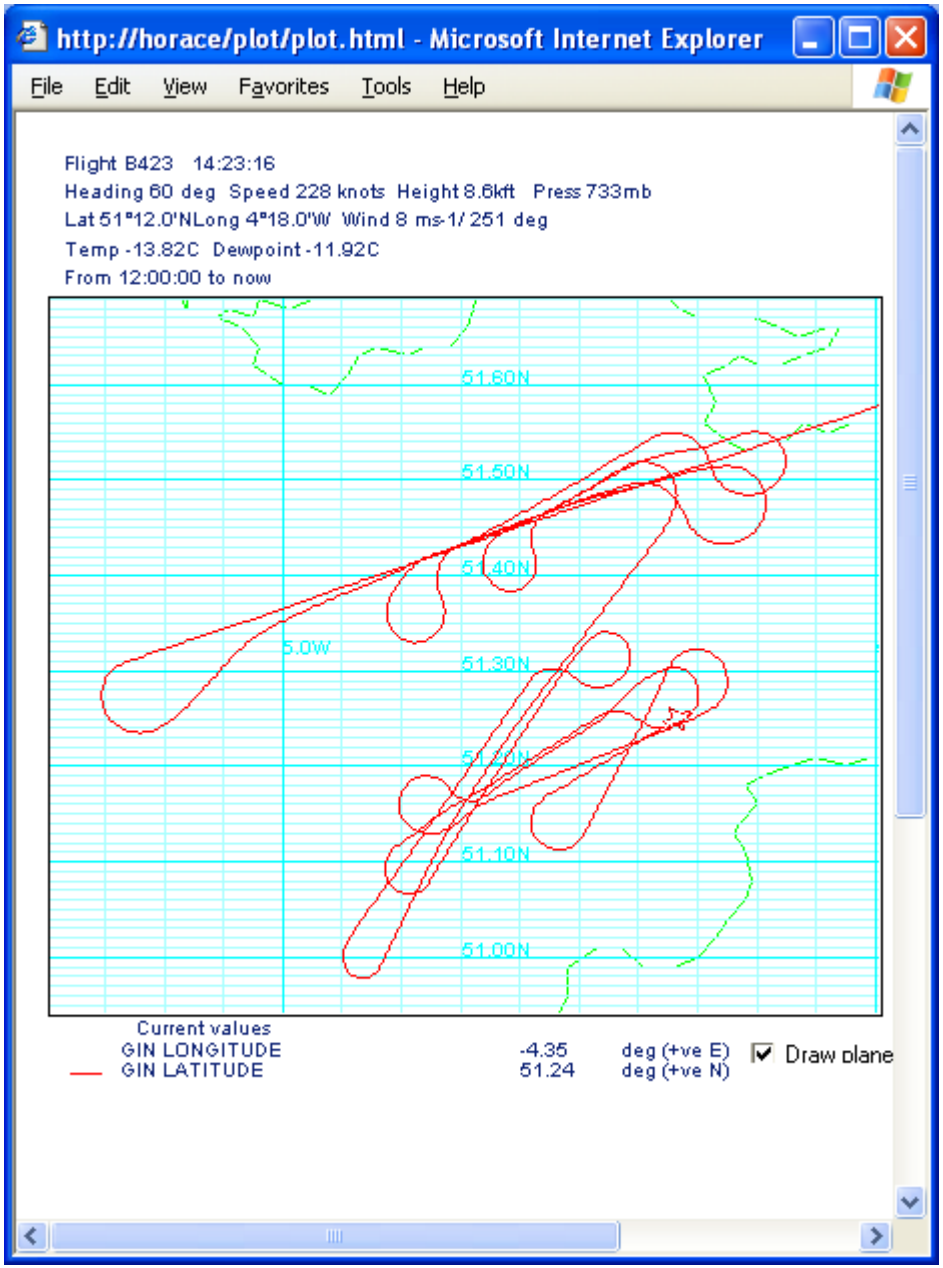
End R12 P12 start



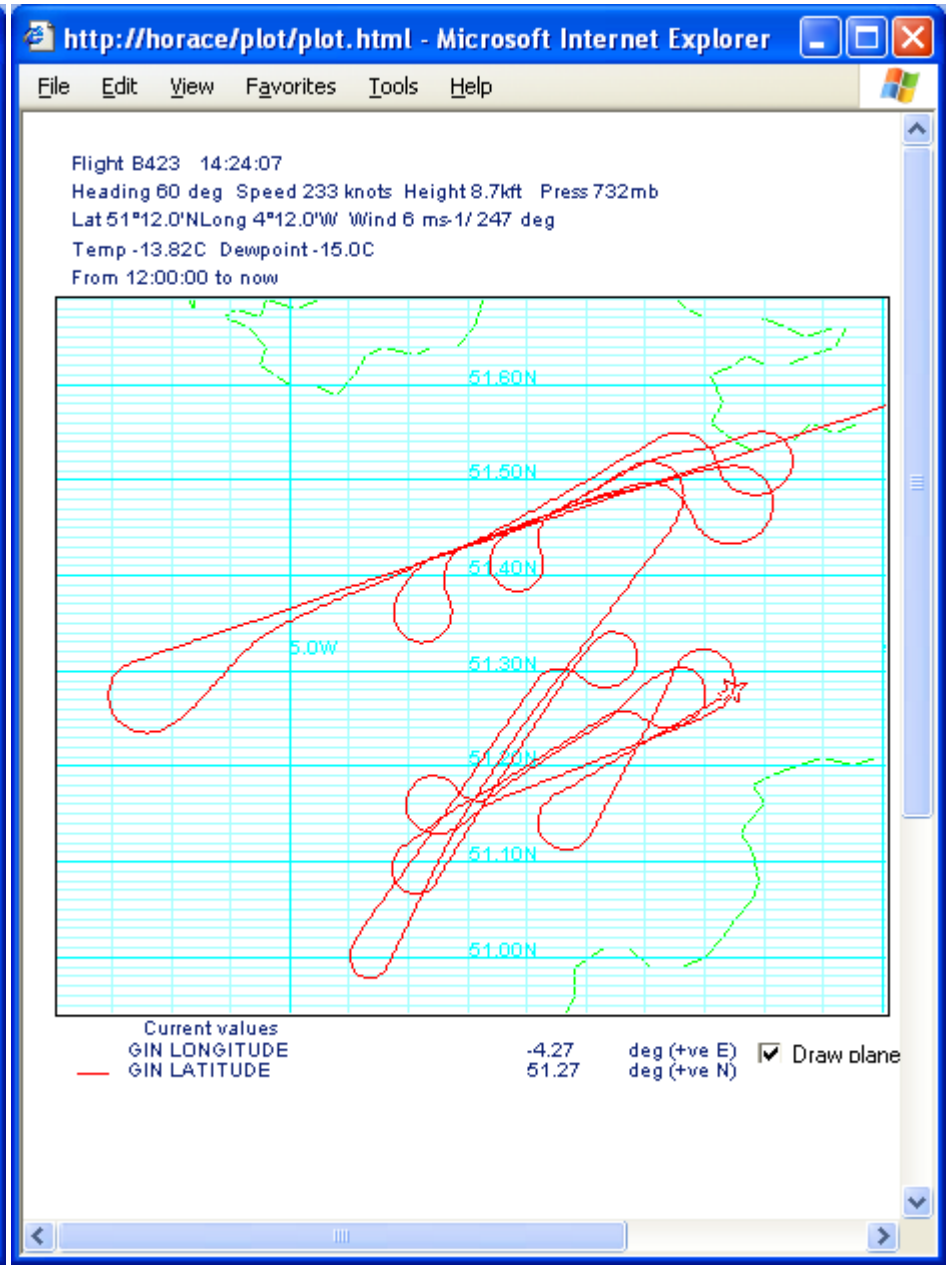


End P12 start R13 at 8000ft

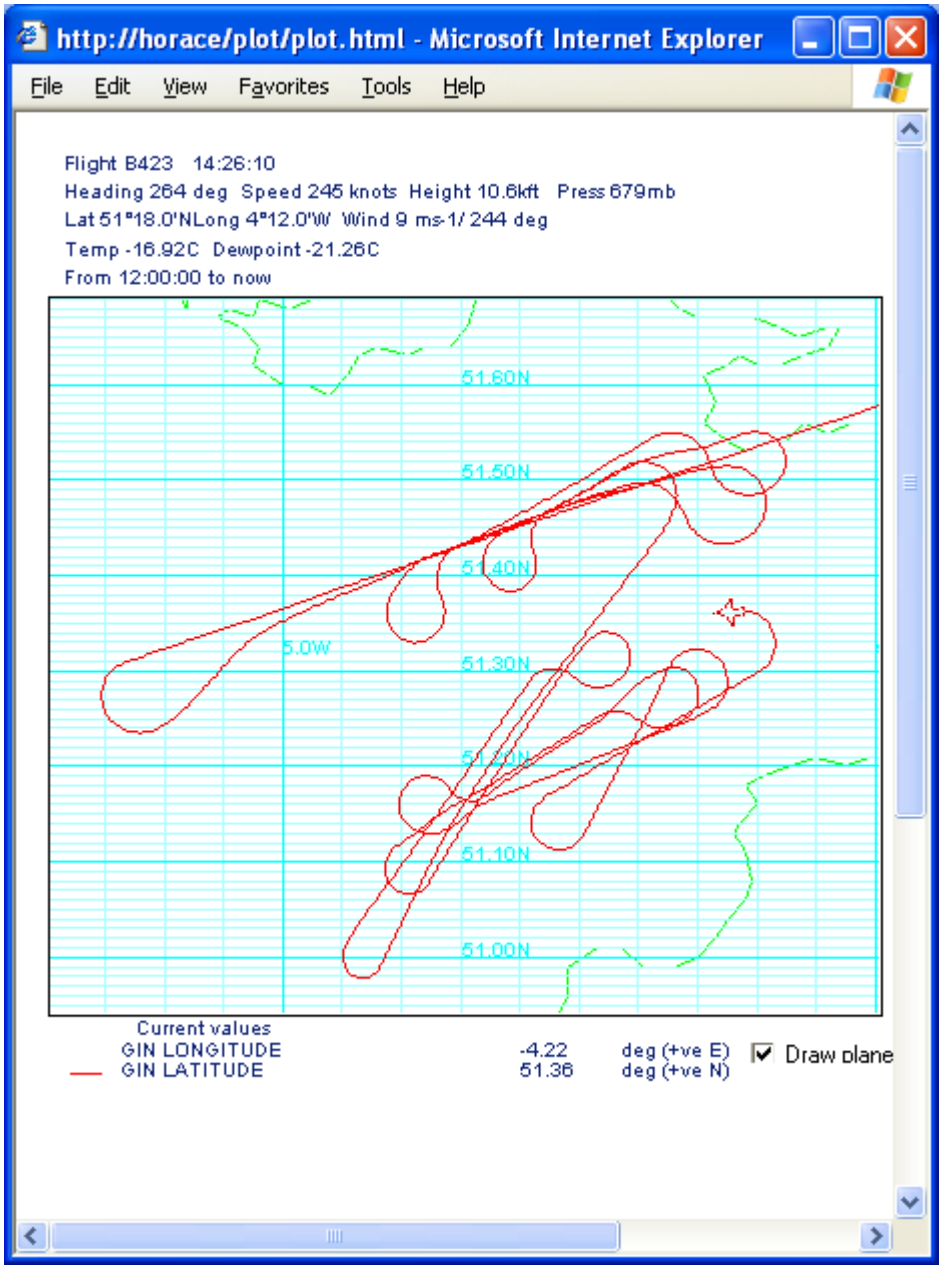
Cloud edge then ppt

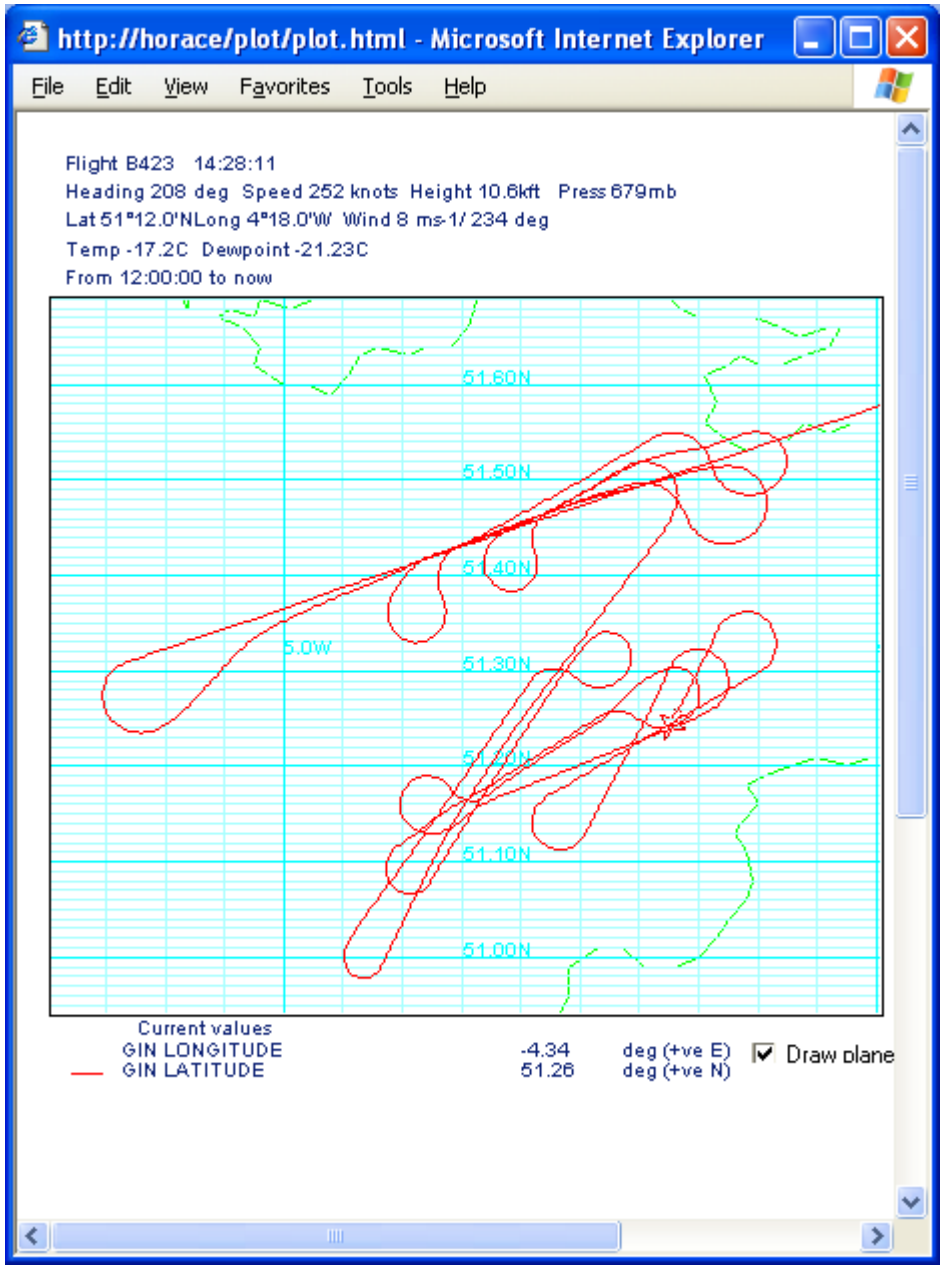


Out of cloud R13



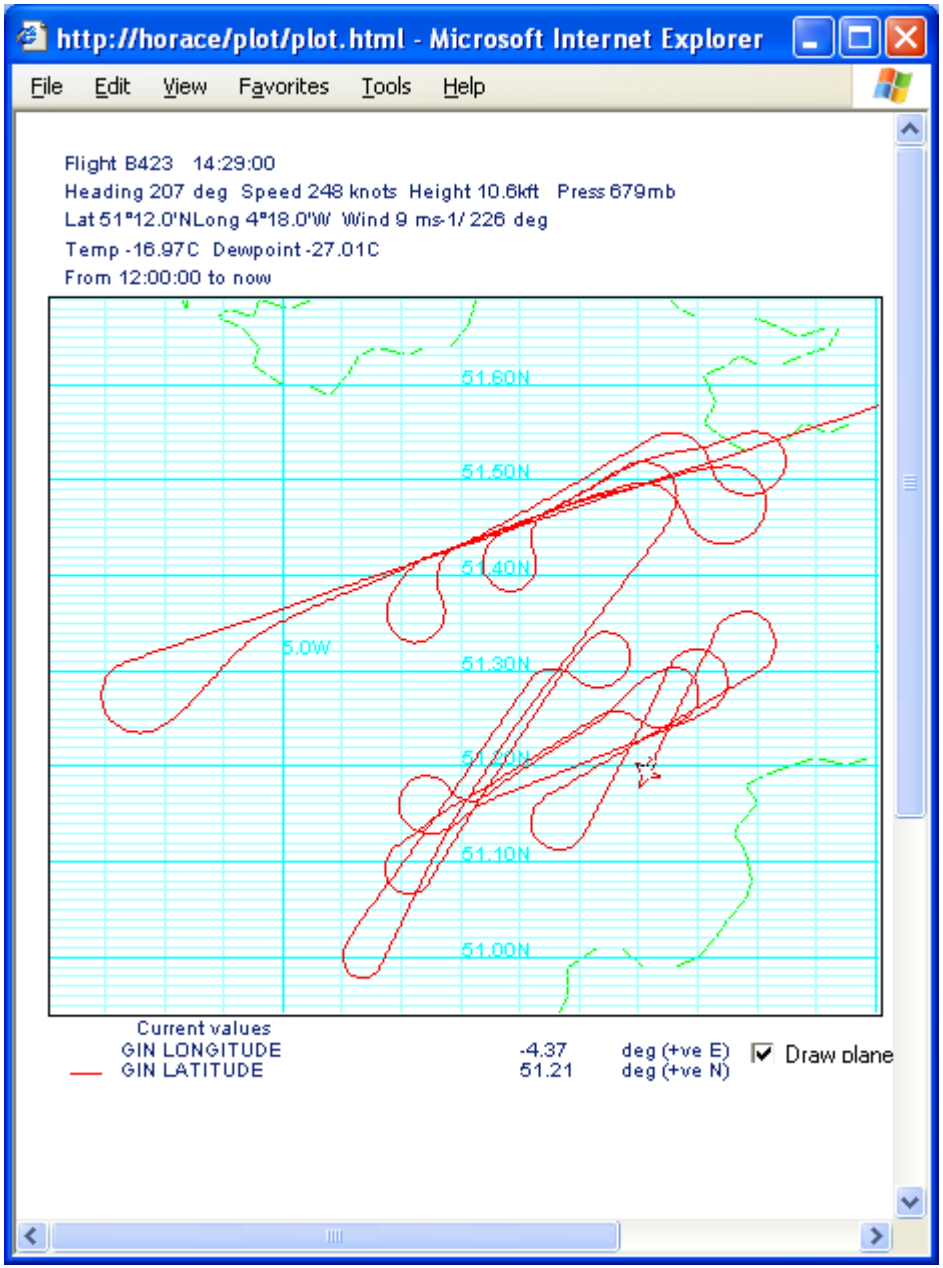
End R13 start P13 at 8000ft



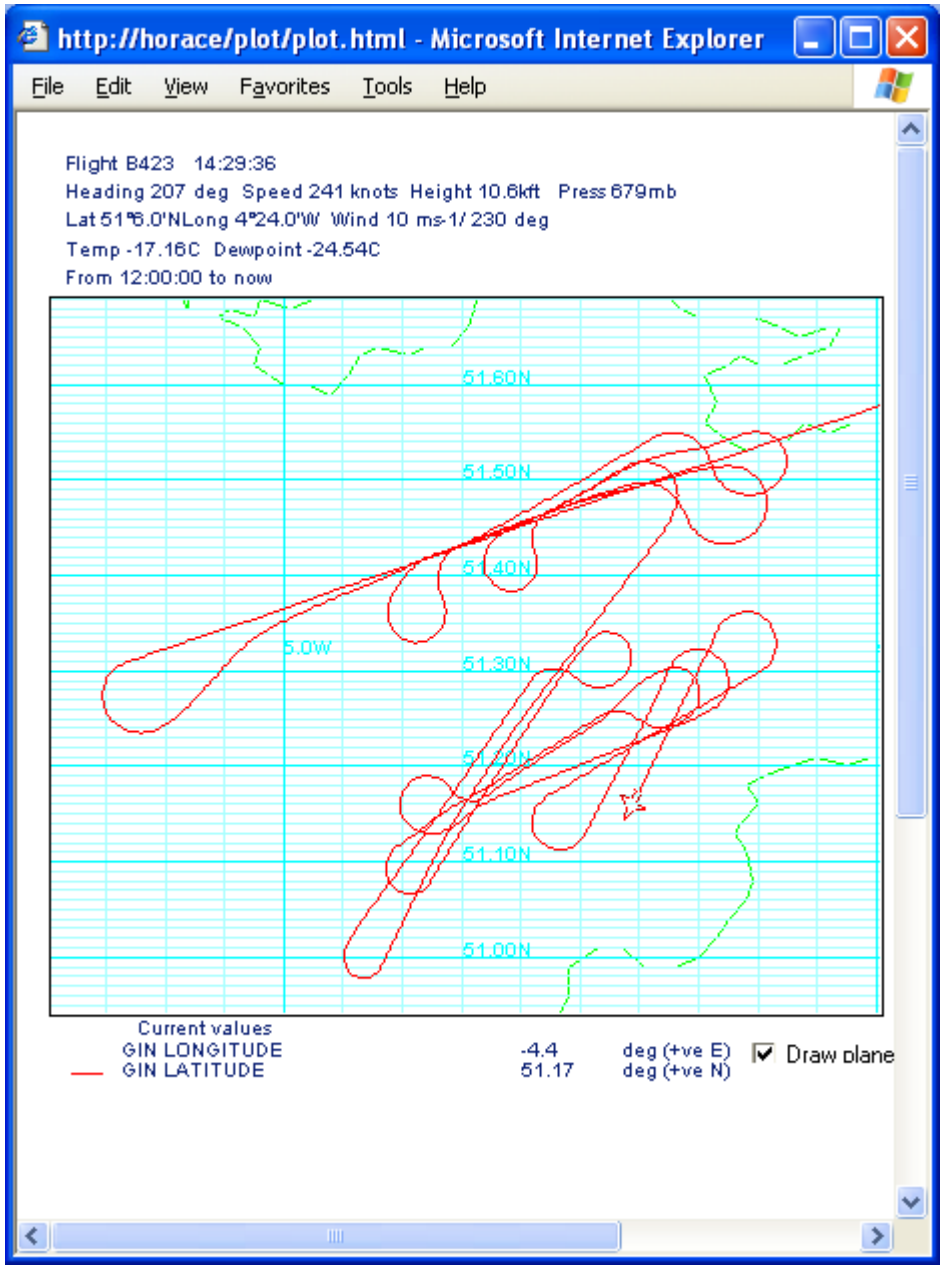


End P13 start R14 at 10000ft

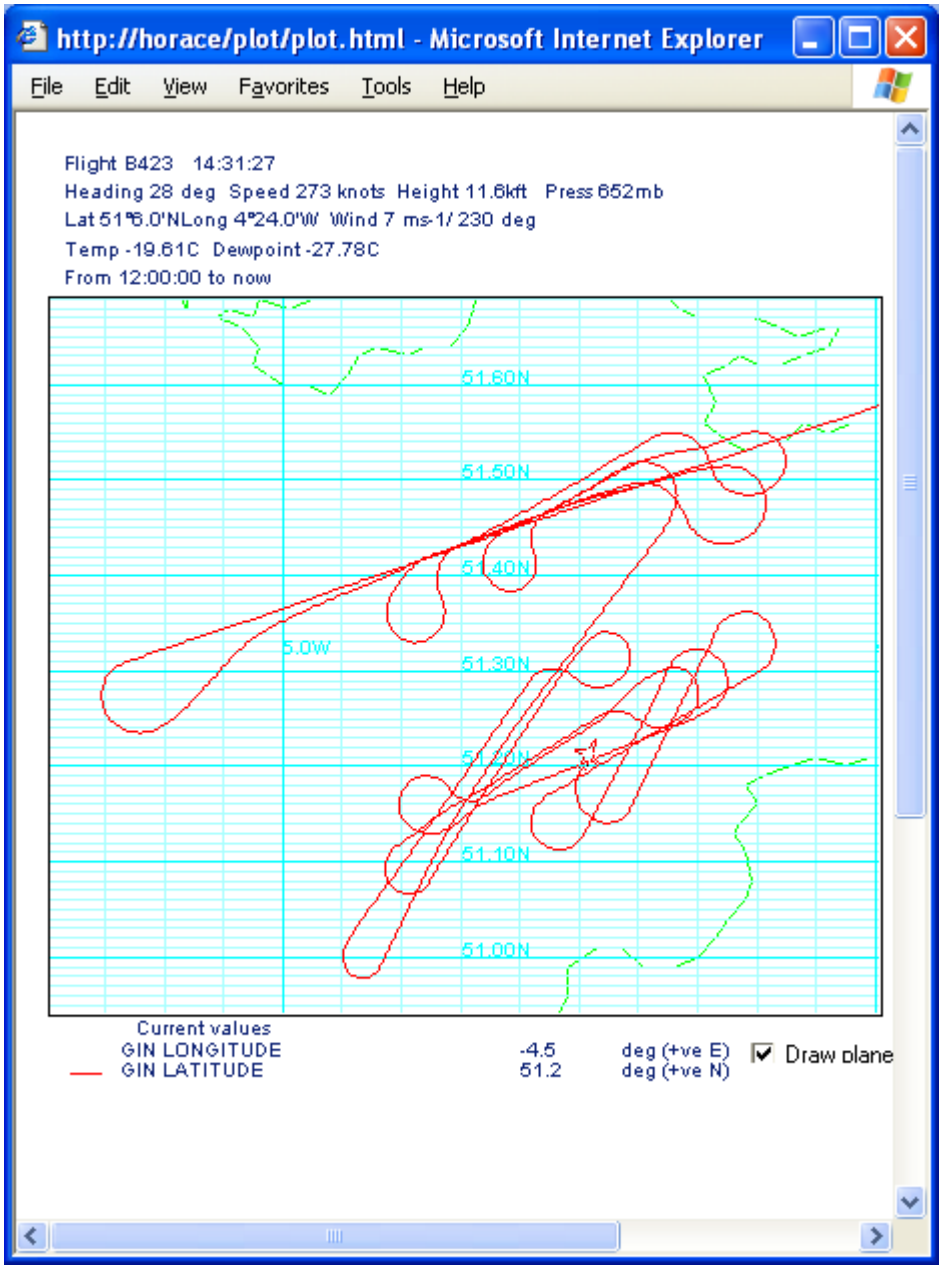
In cloud and bumpy



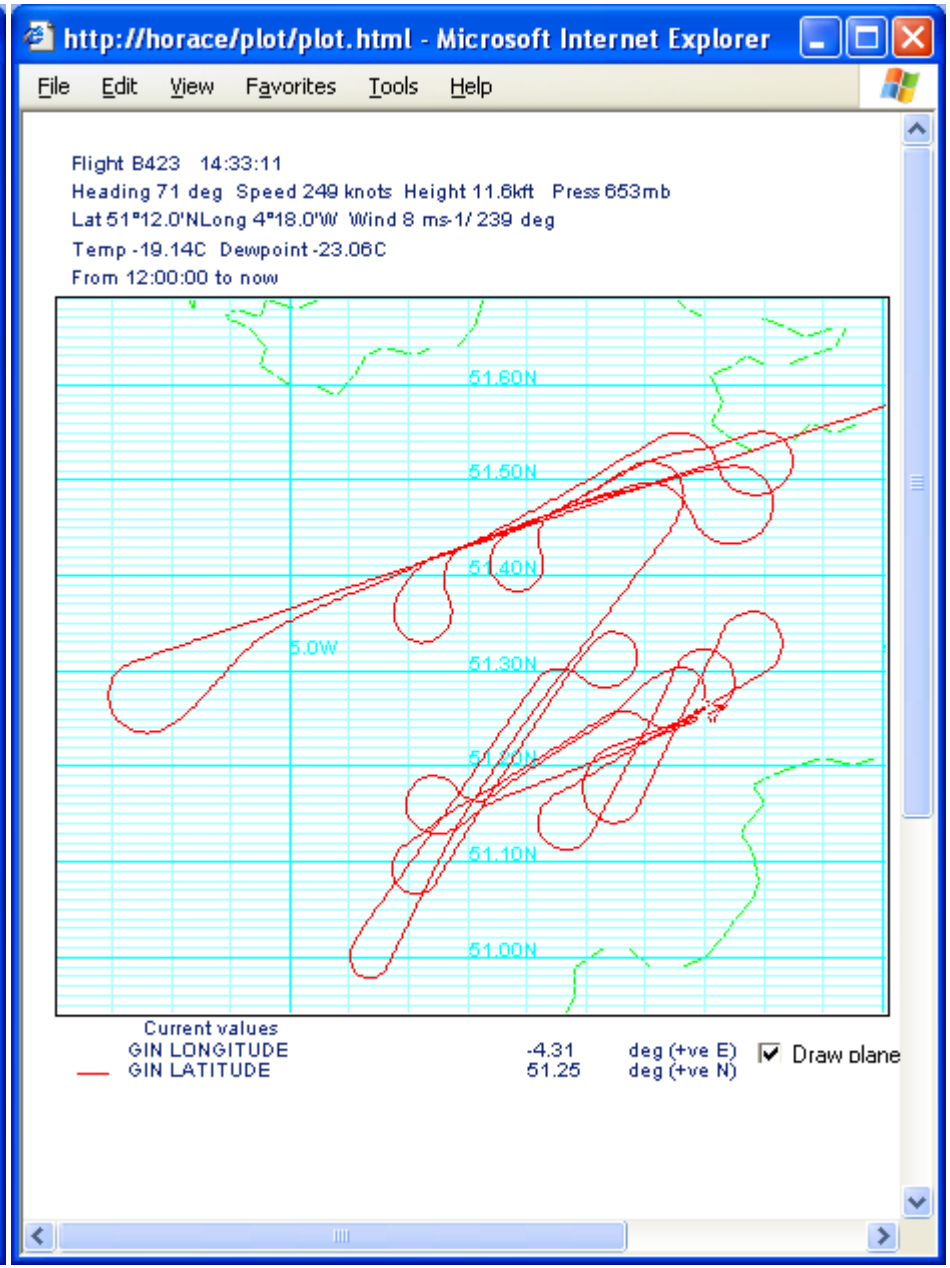
Out of cloud R14



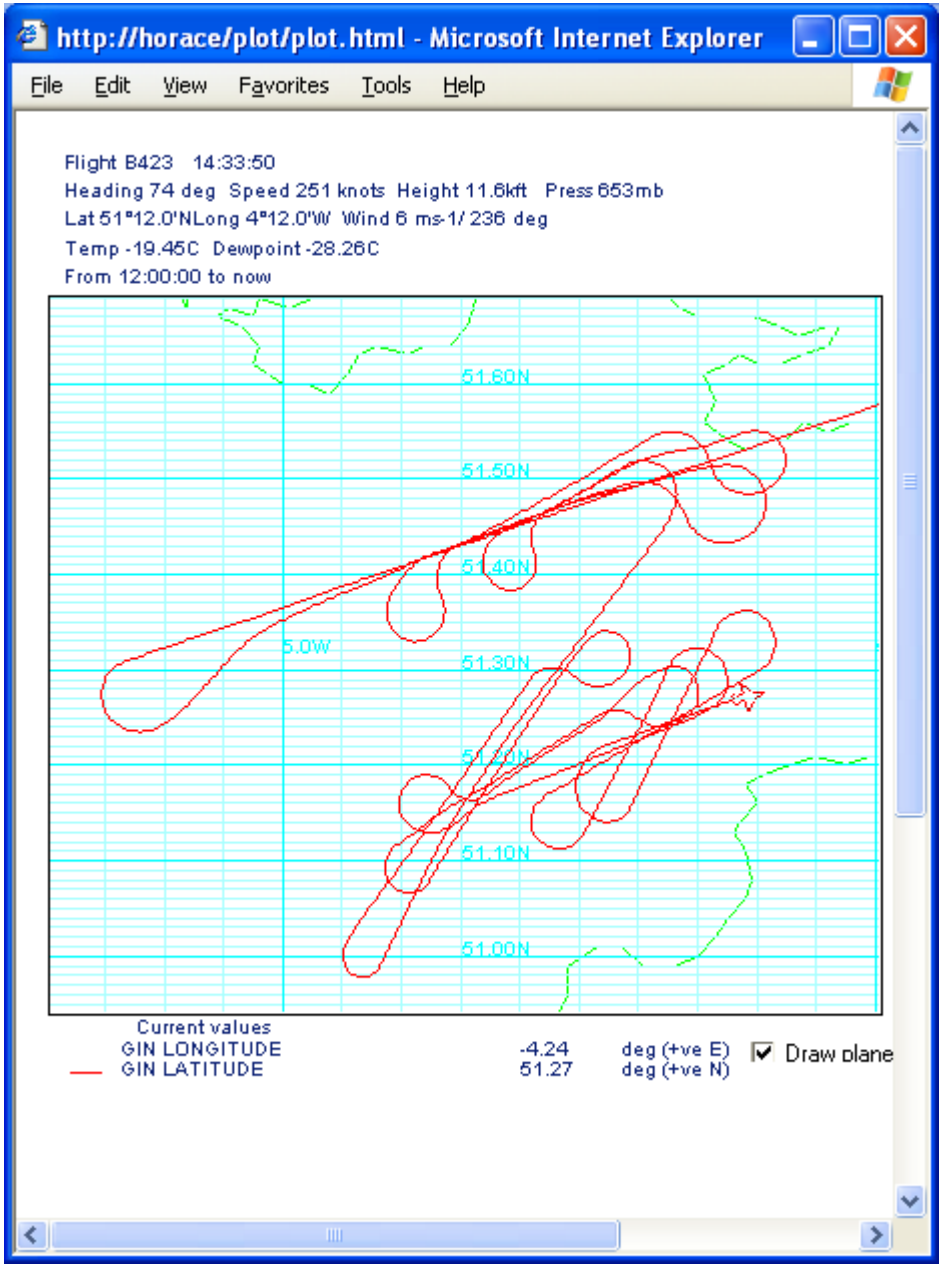
End R14 start P14

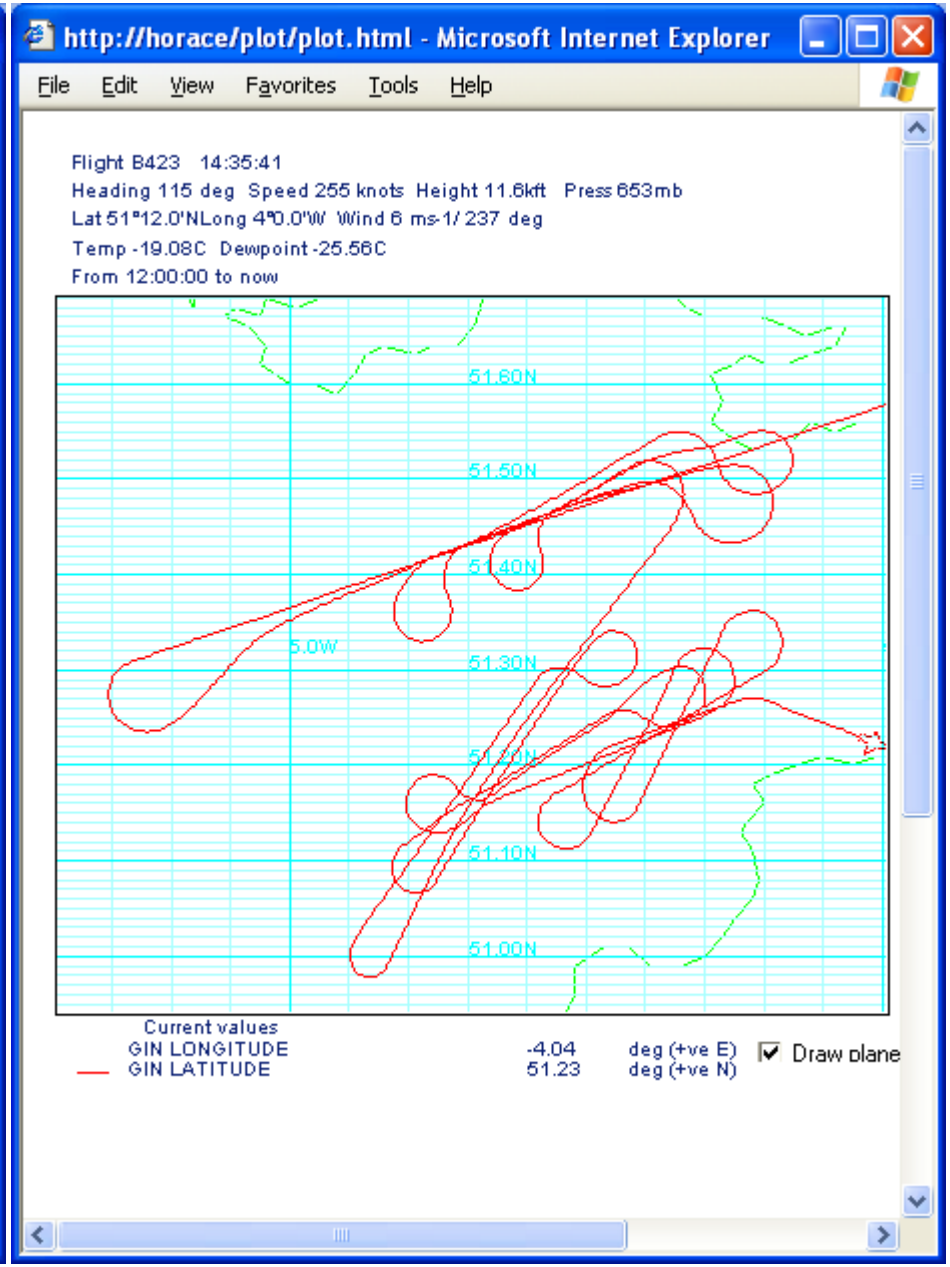


End P14 start R15



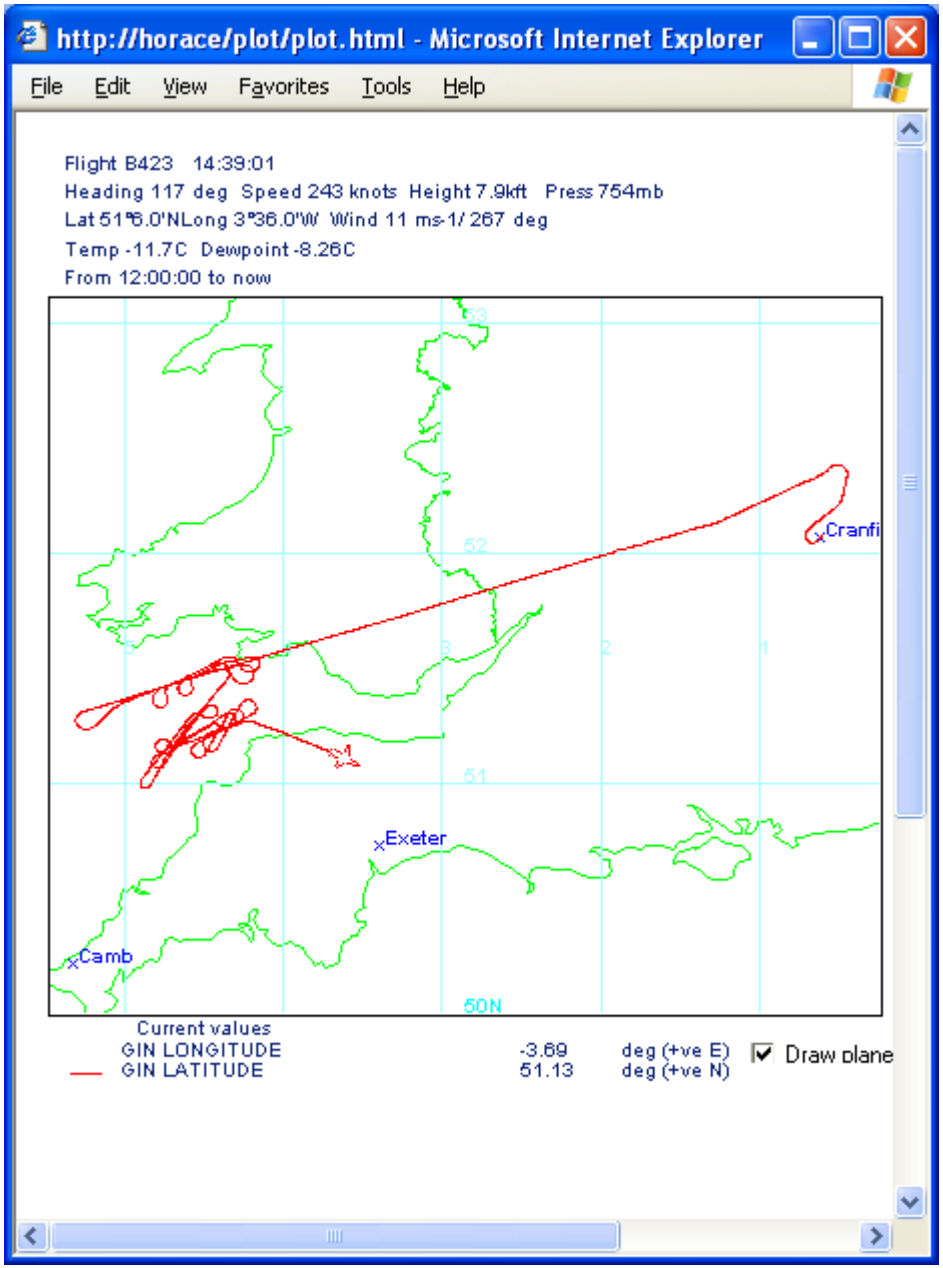
In and out of cloud

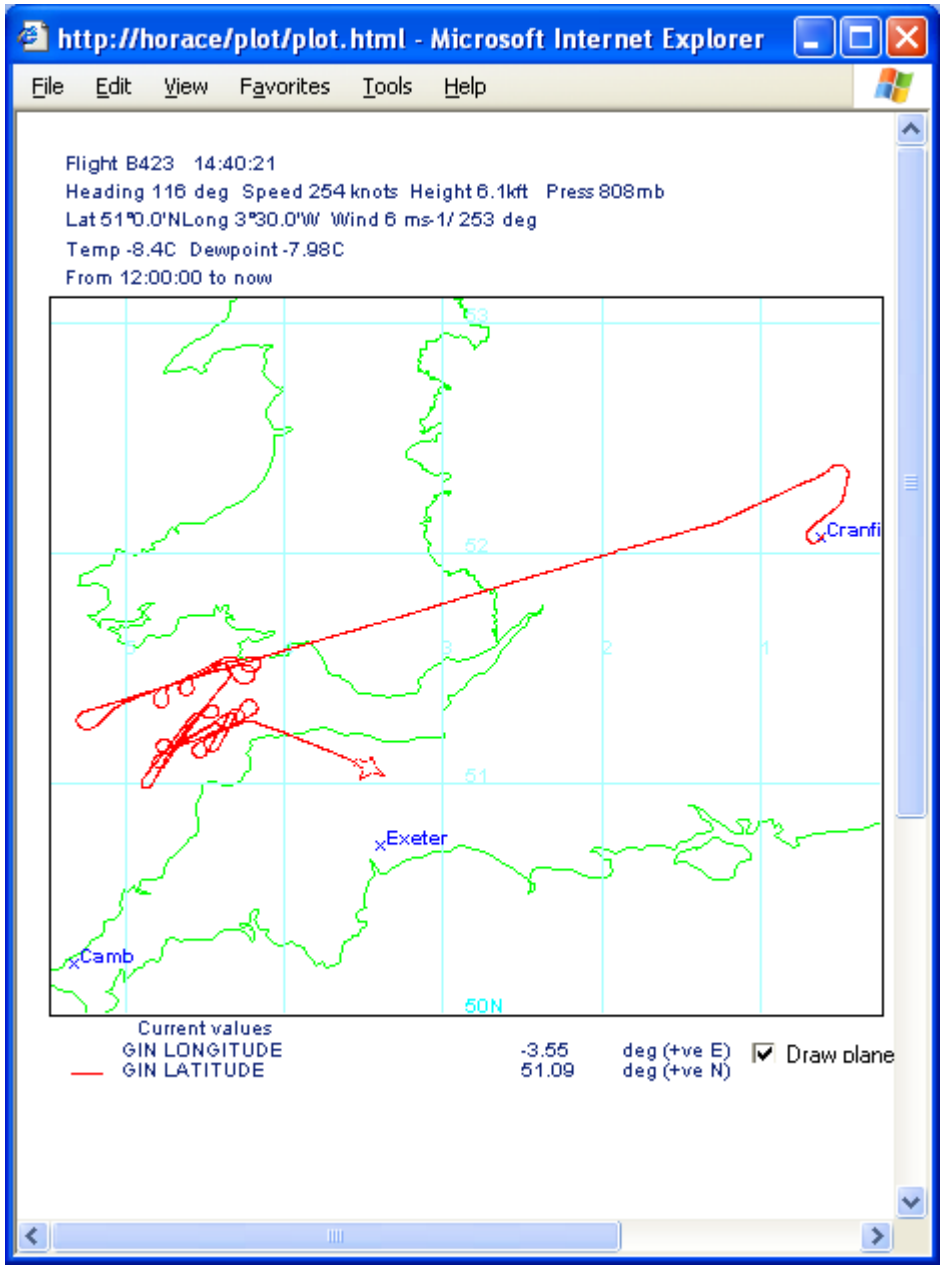




End R15 at 11000ft

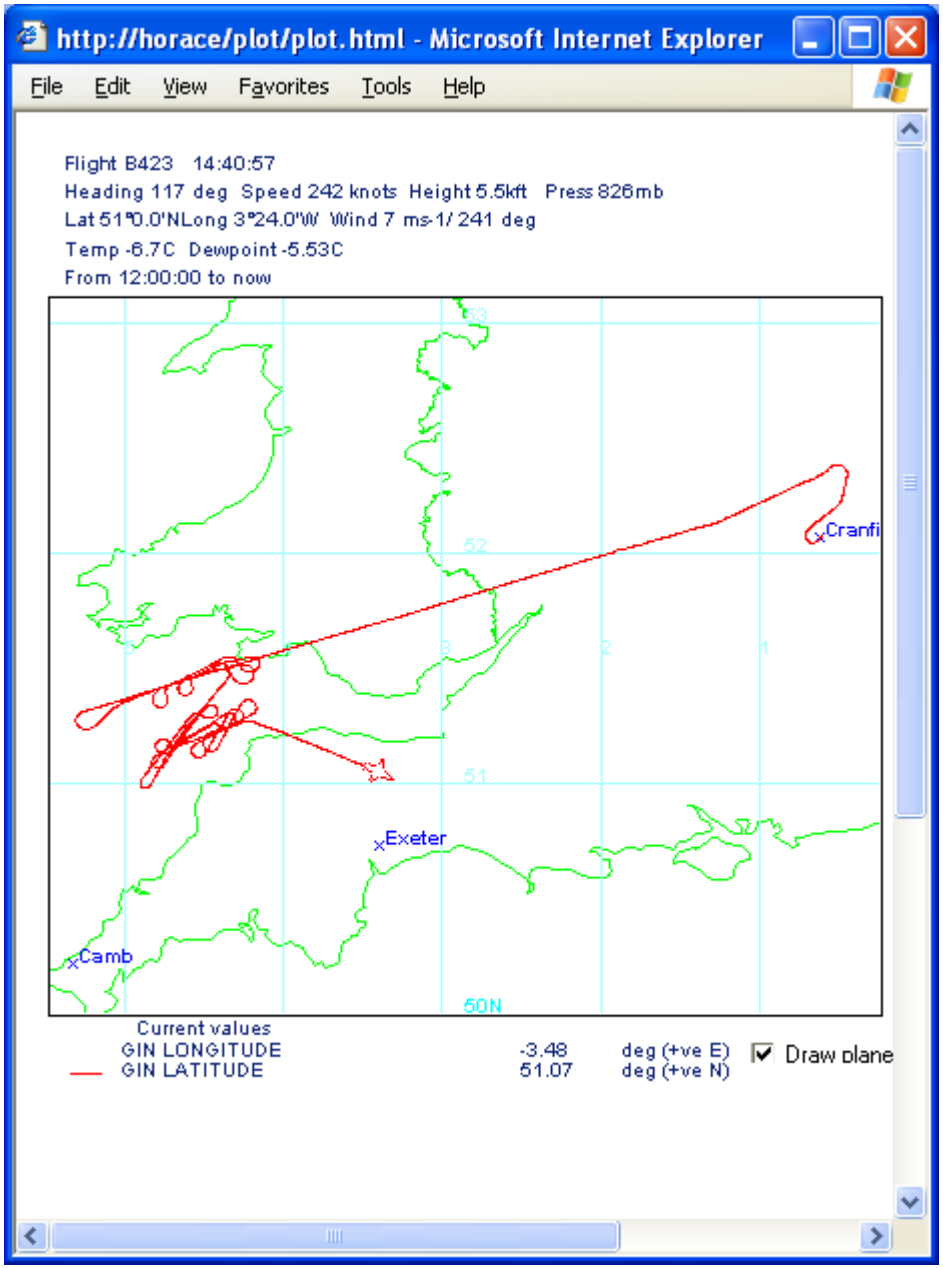
Start P15

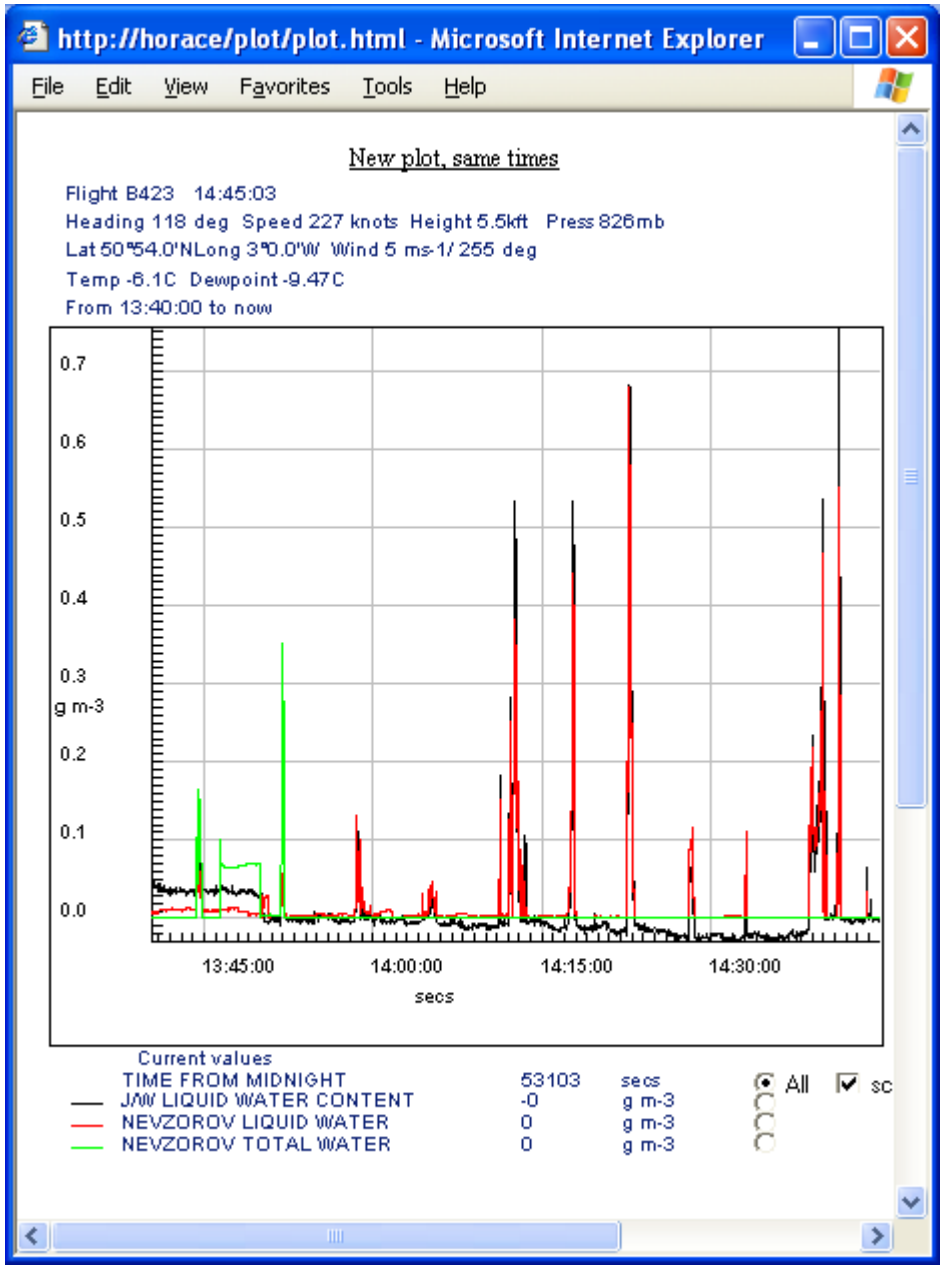




P15 - Ice detected

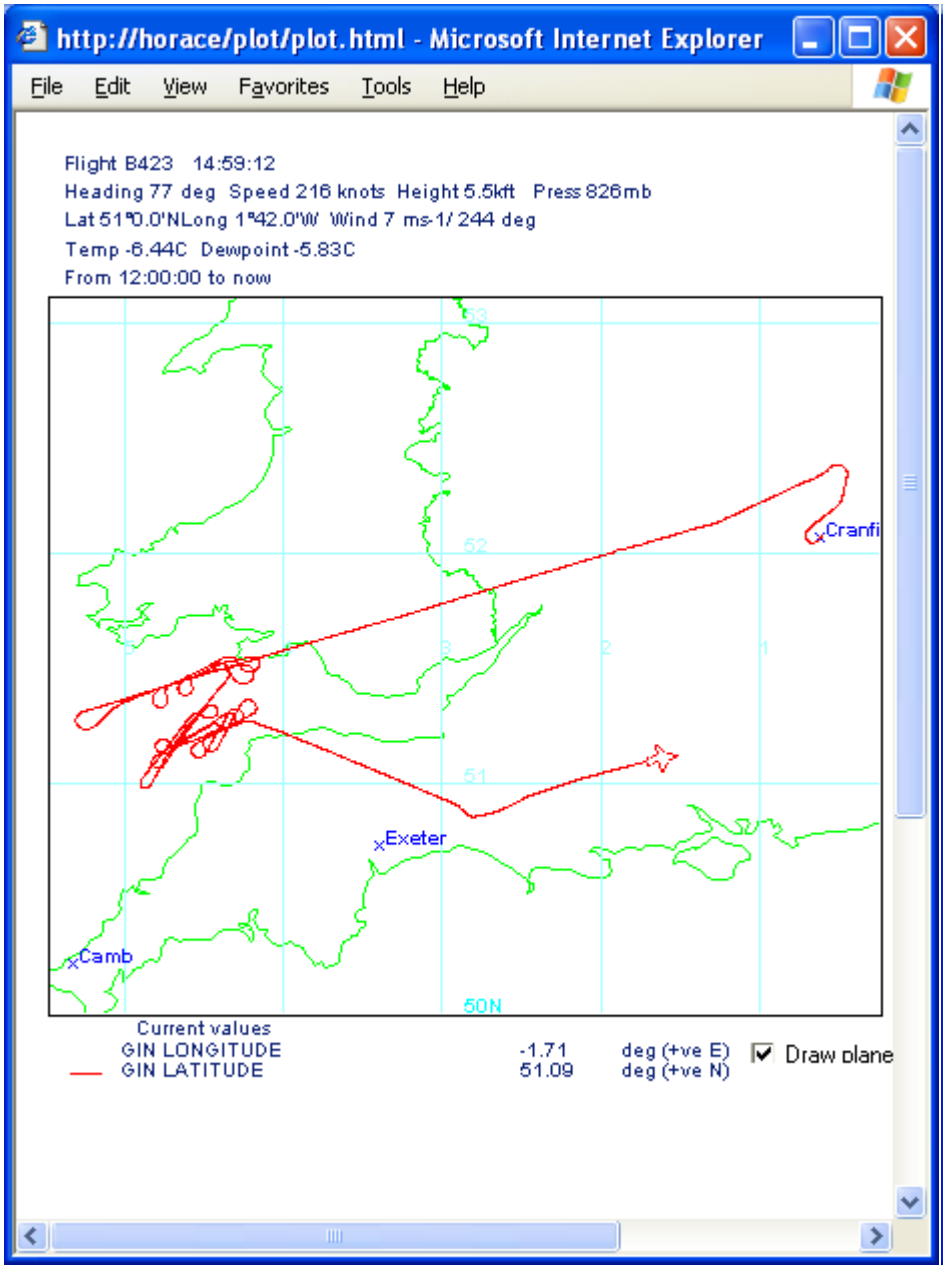
CB

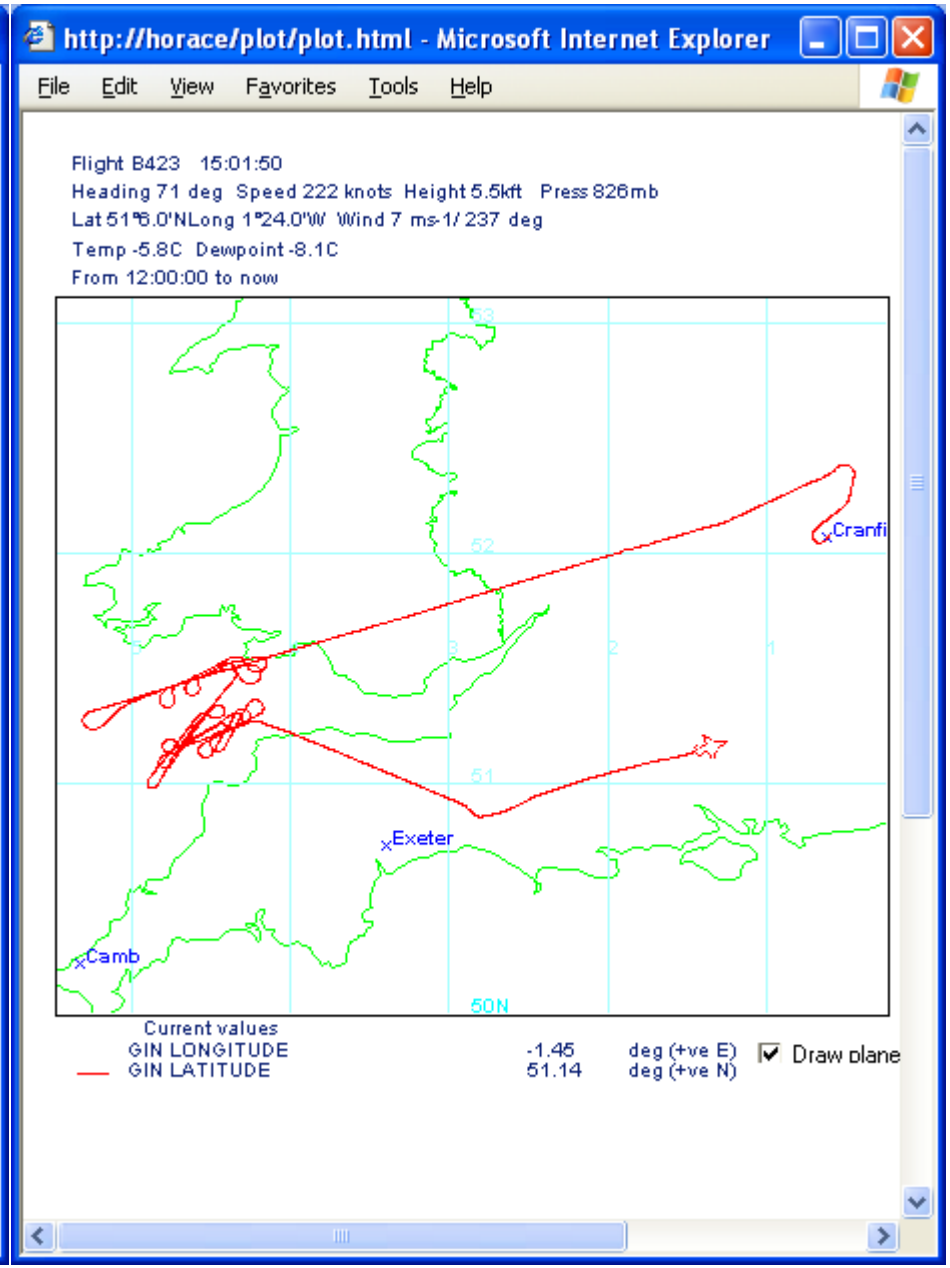




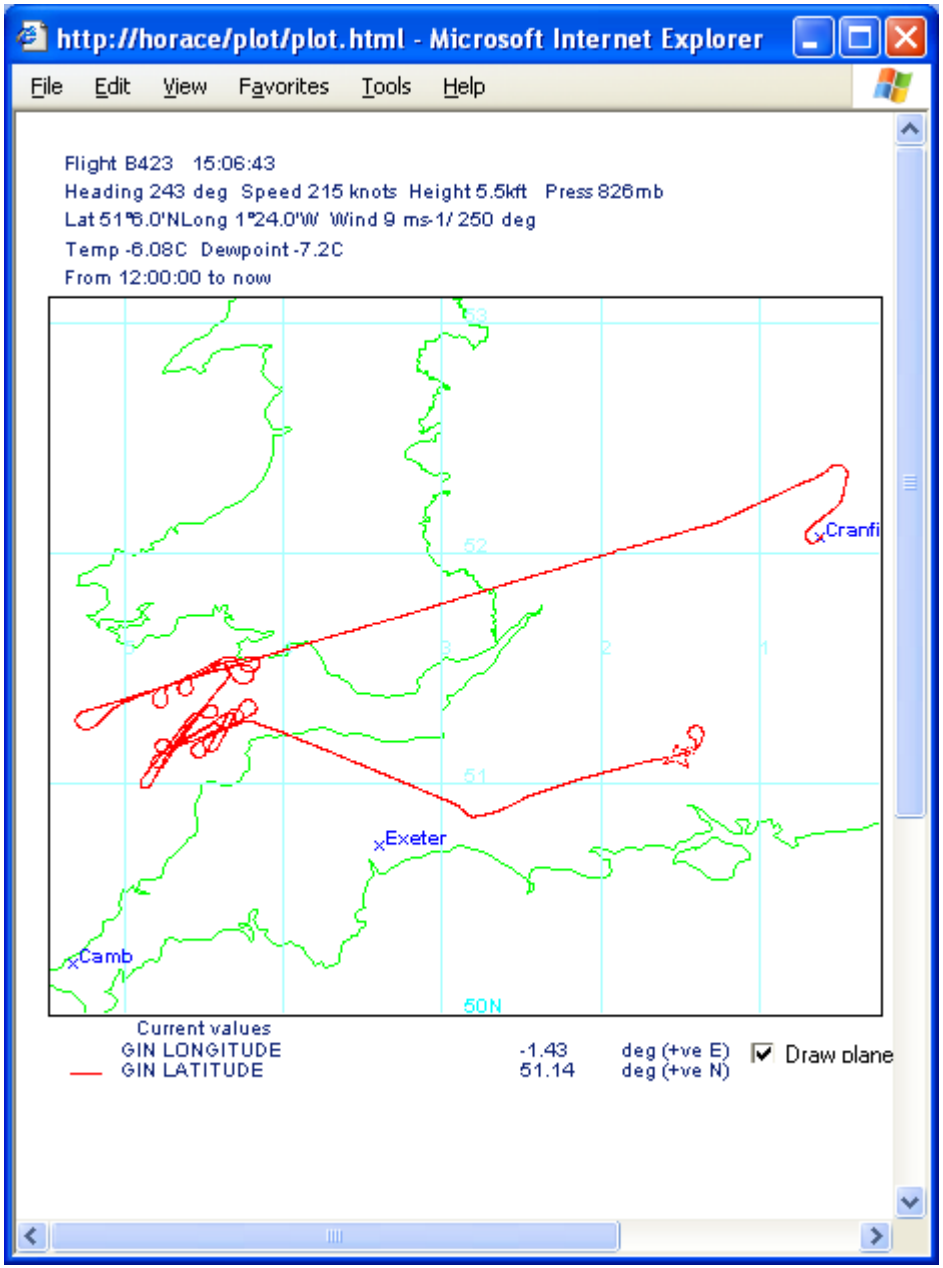
Start R16 5500ft

Last cloud - water

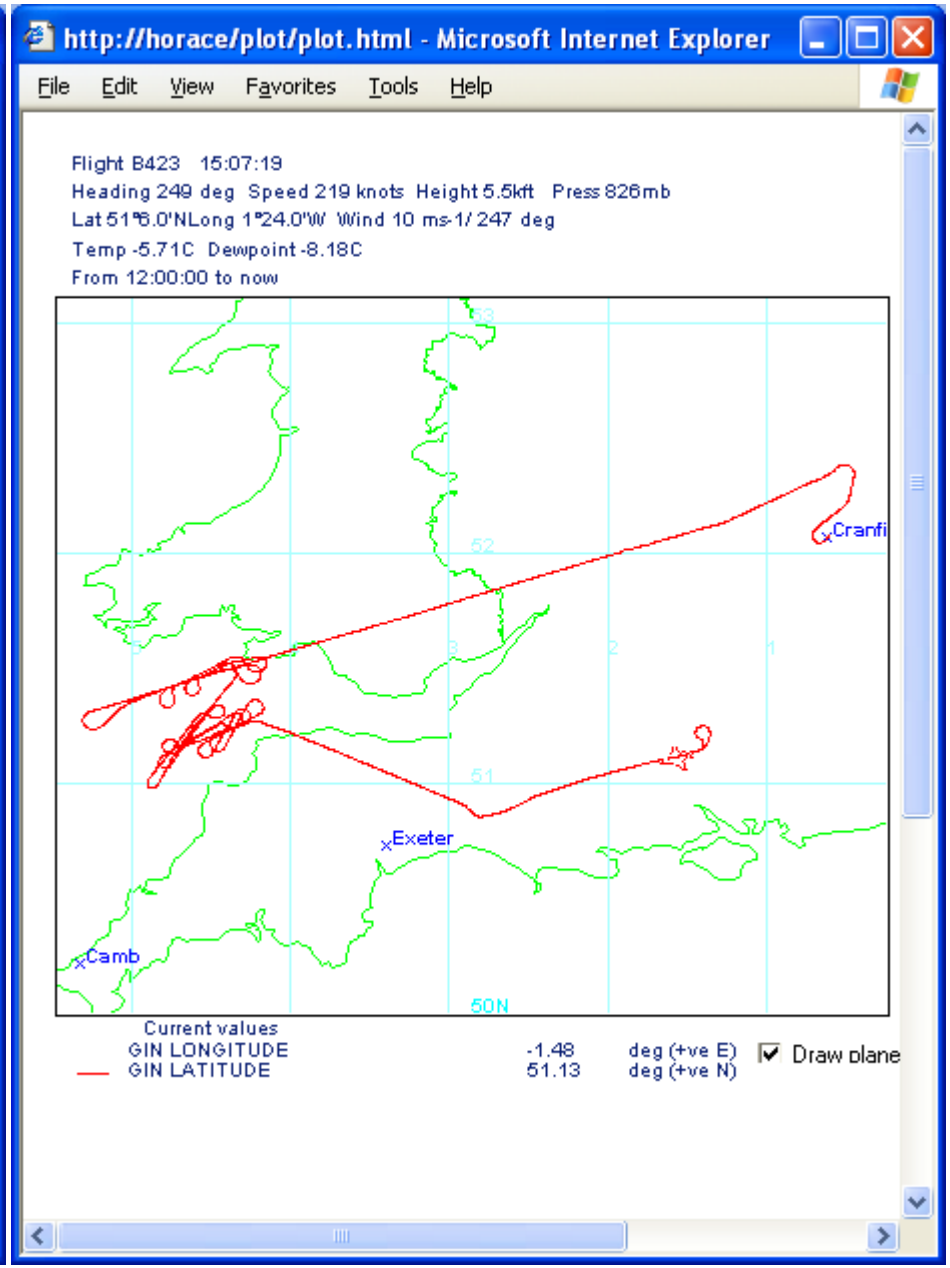




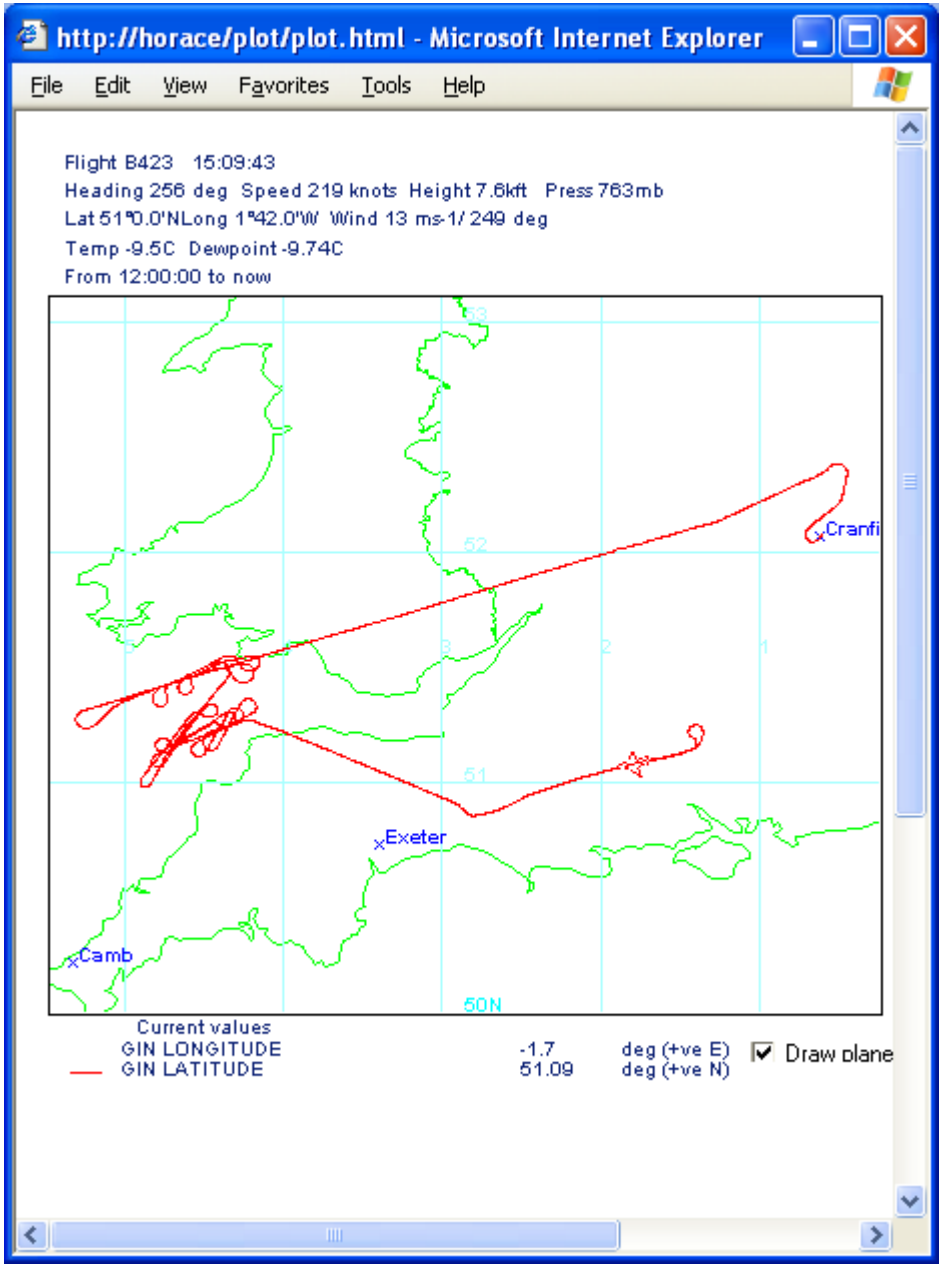
R16 Chilbolton



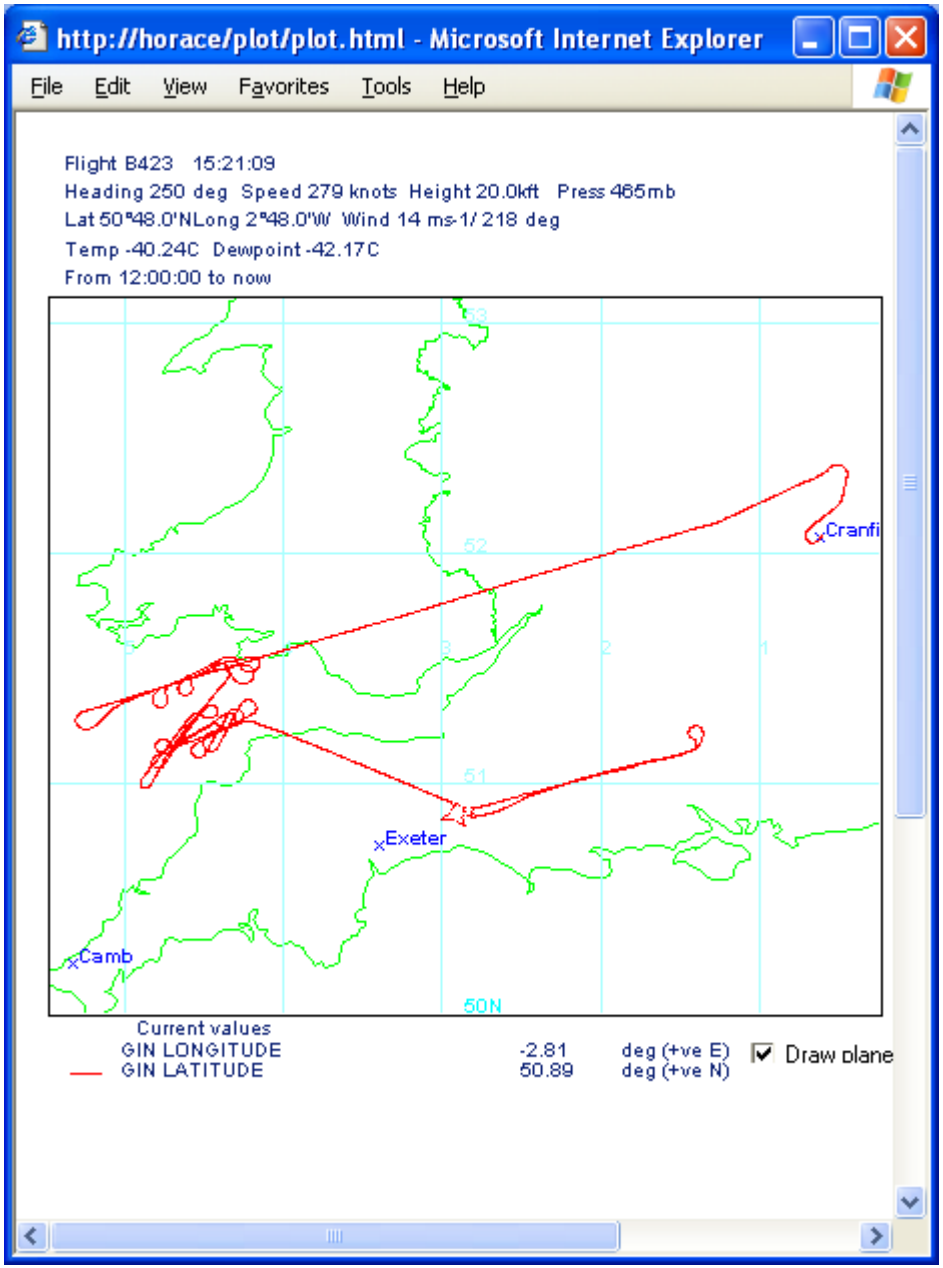
Over Chilbolton outbound

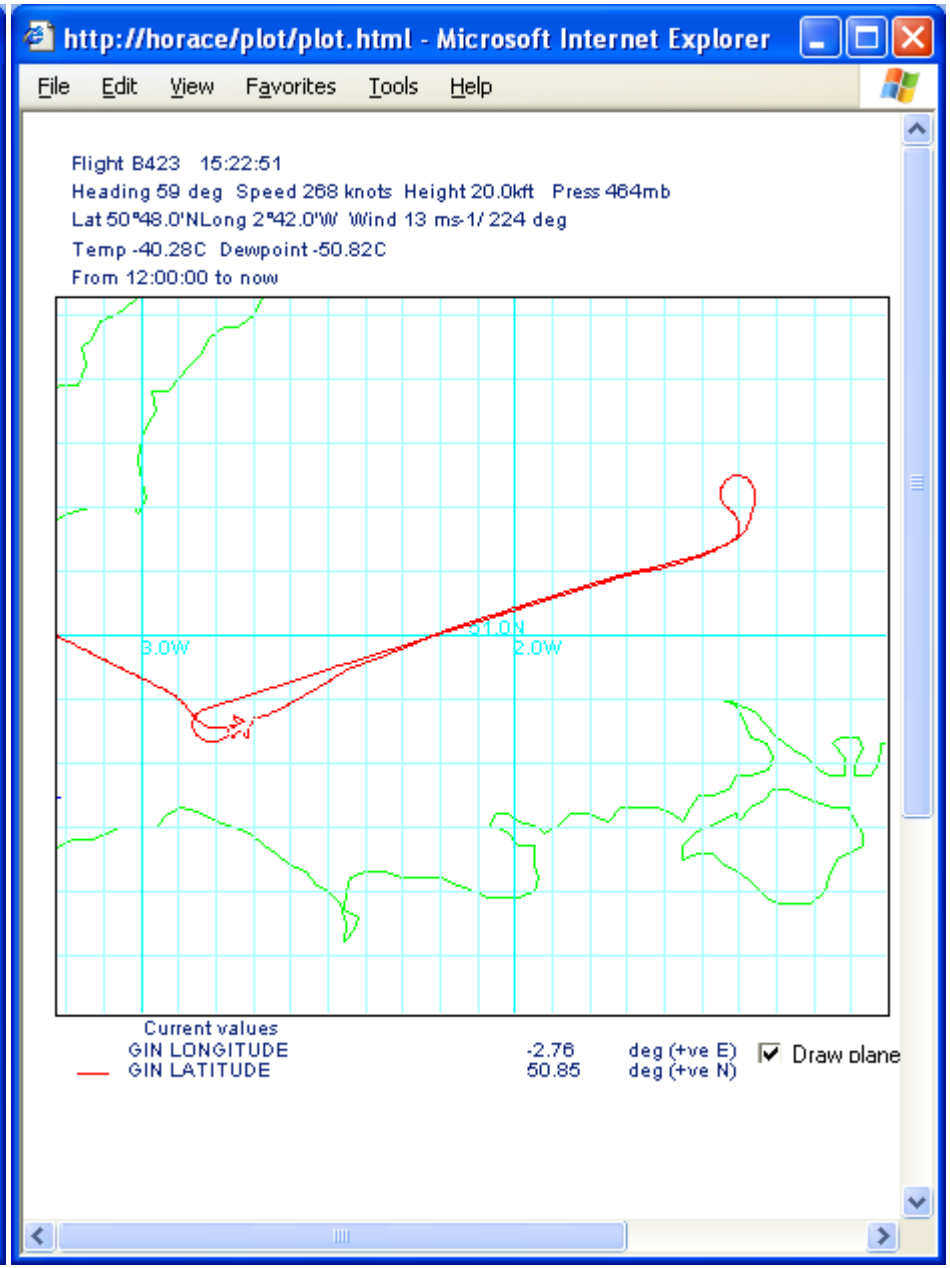


End R16 start Profile 16



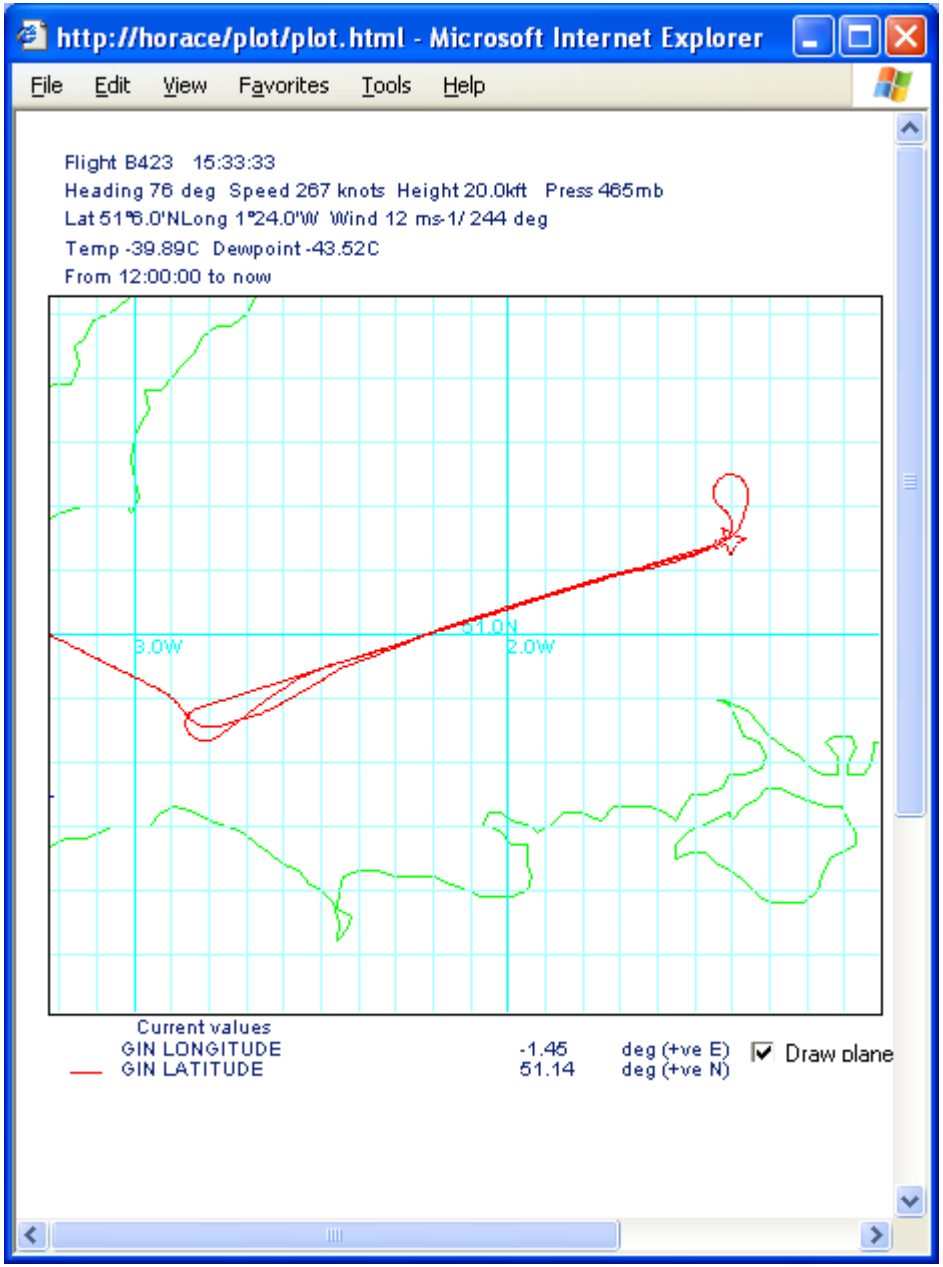
P16 cloud out to left (south) of us over S coast

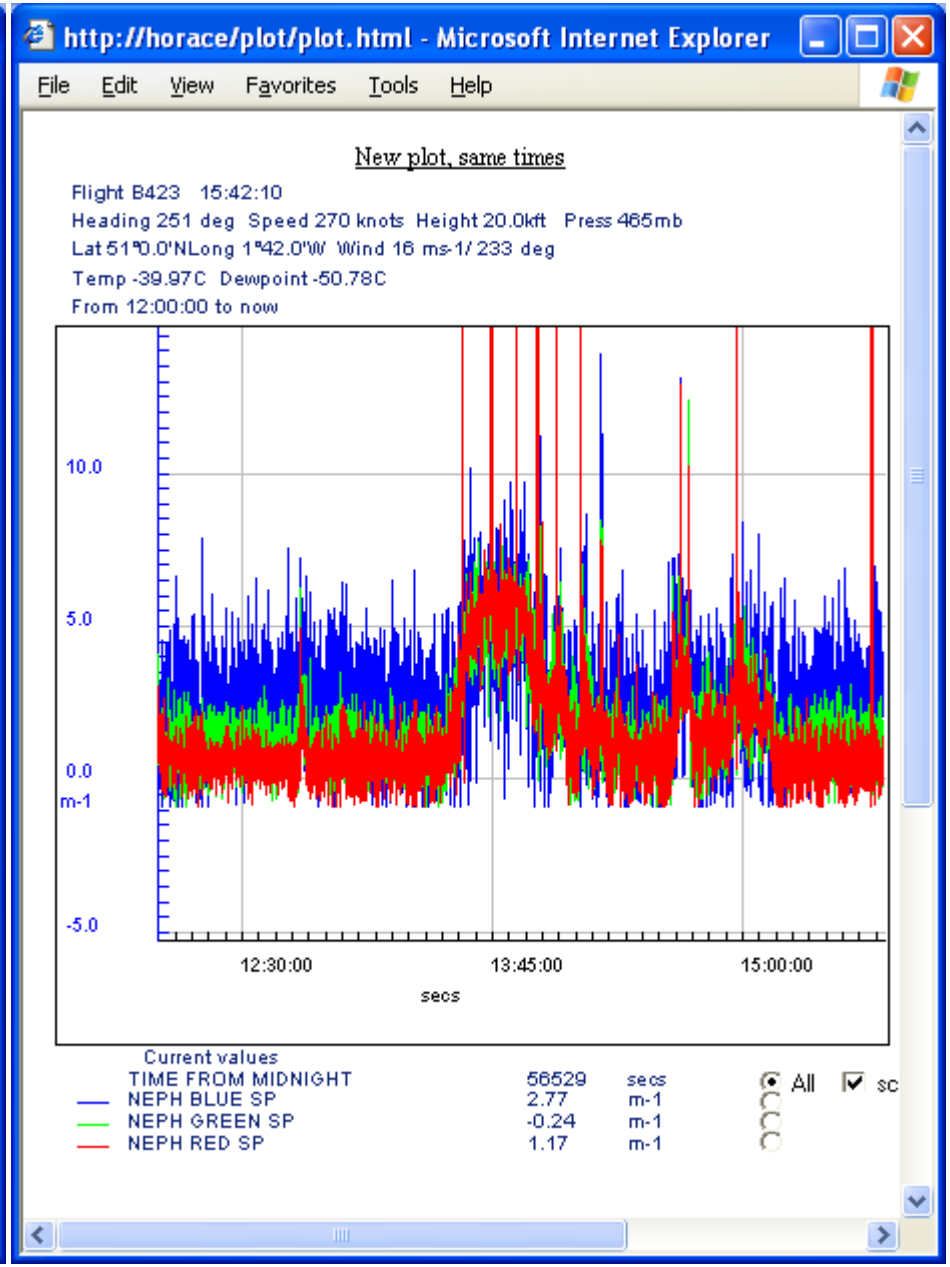




End P16 start R17 FL200

SLR part of R17





Overhead Chilbolton

http://horace/plot/plot.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

New plot, same times

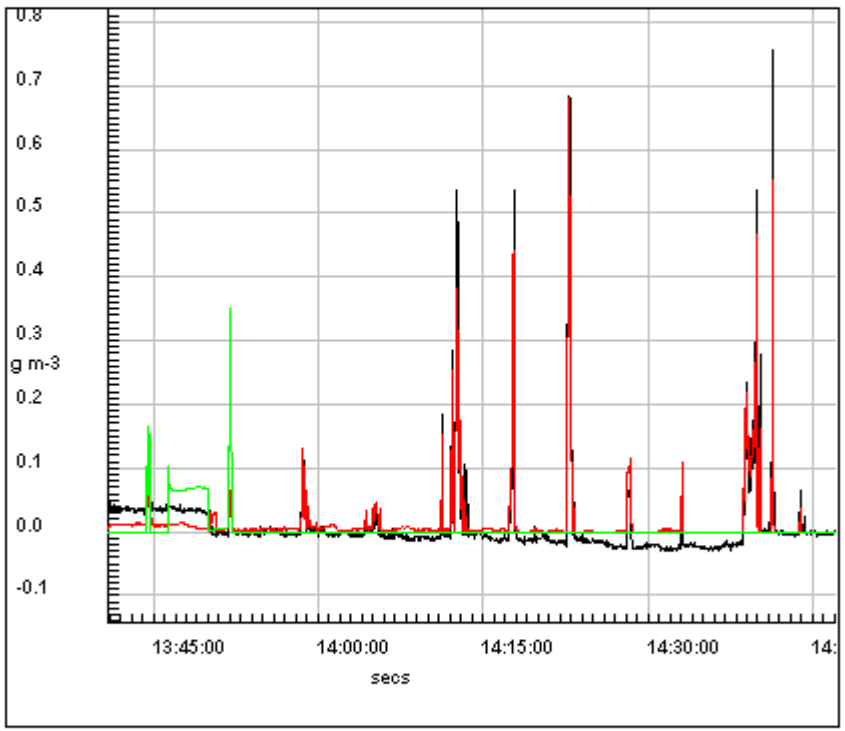
Flight B423 15:44:39

Heading 252 deg Speed 259 knots Height 20.0kft Press 465mb

Lat 51°0.0'N Long 1°54.0'W Wind 15 ms-1/ 228 deg

Temp -40.1C Dewpoint -46.8C

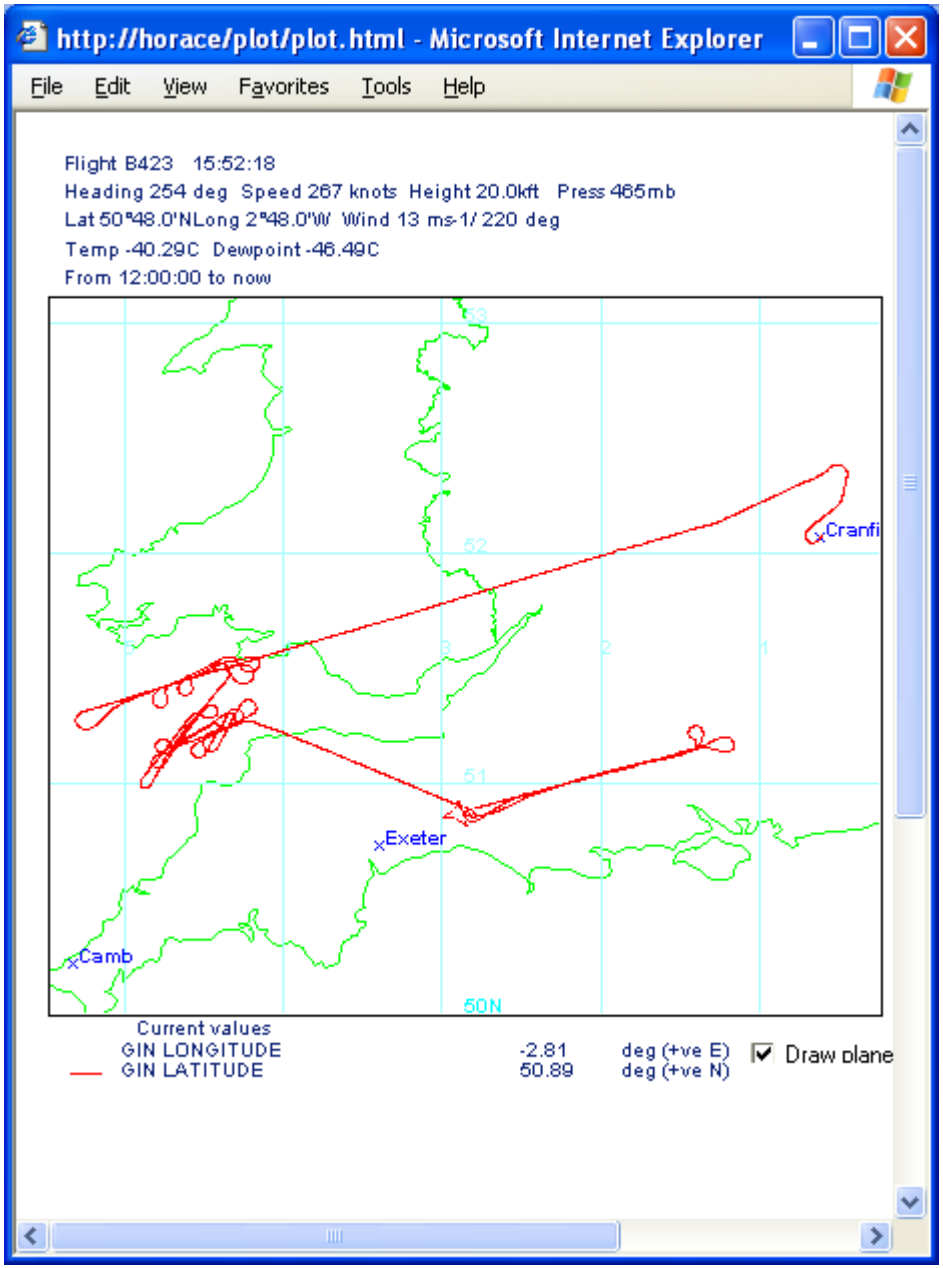
From 13:40:00 to now

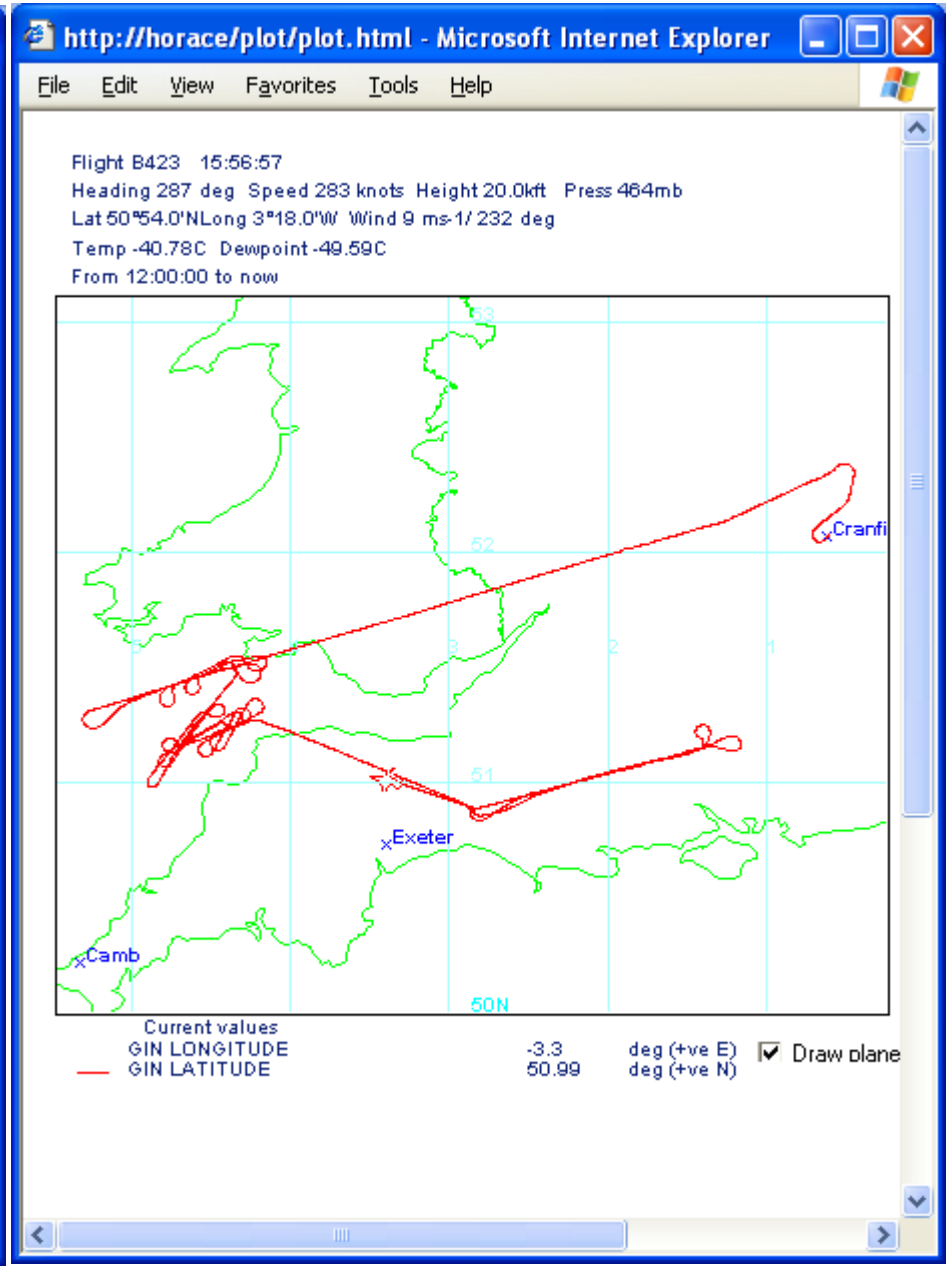


Current values

TIME FROM MIDNIGHT	56679	secs	
JAW LIQUID WATER CONTENT	0	g m-3	
NEVZOROV LIQUID WATER	0	g m-3	
NEVZOROV TOTAL WATER	0	g m-3	

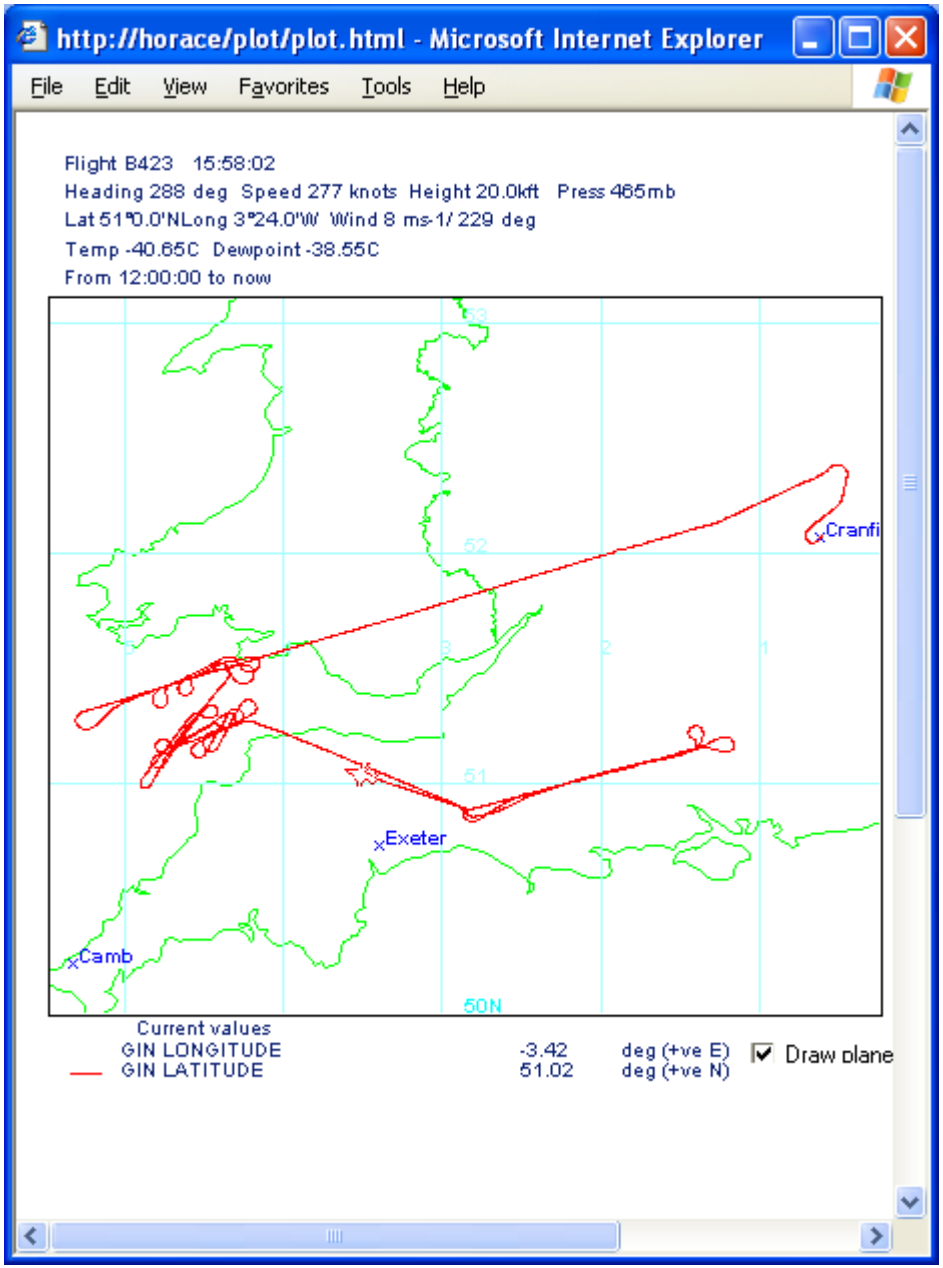
All sc

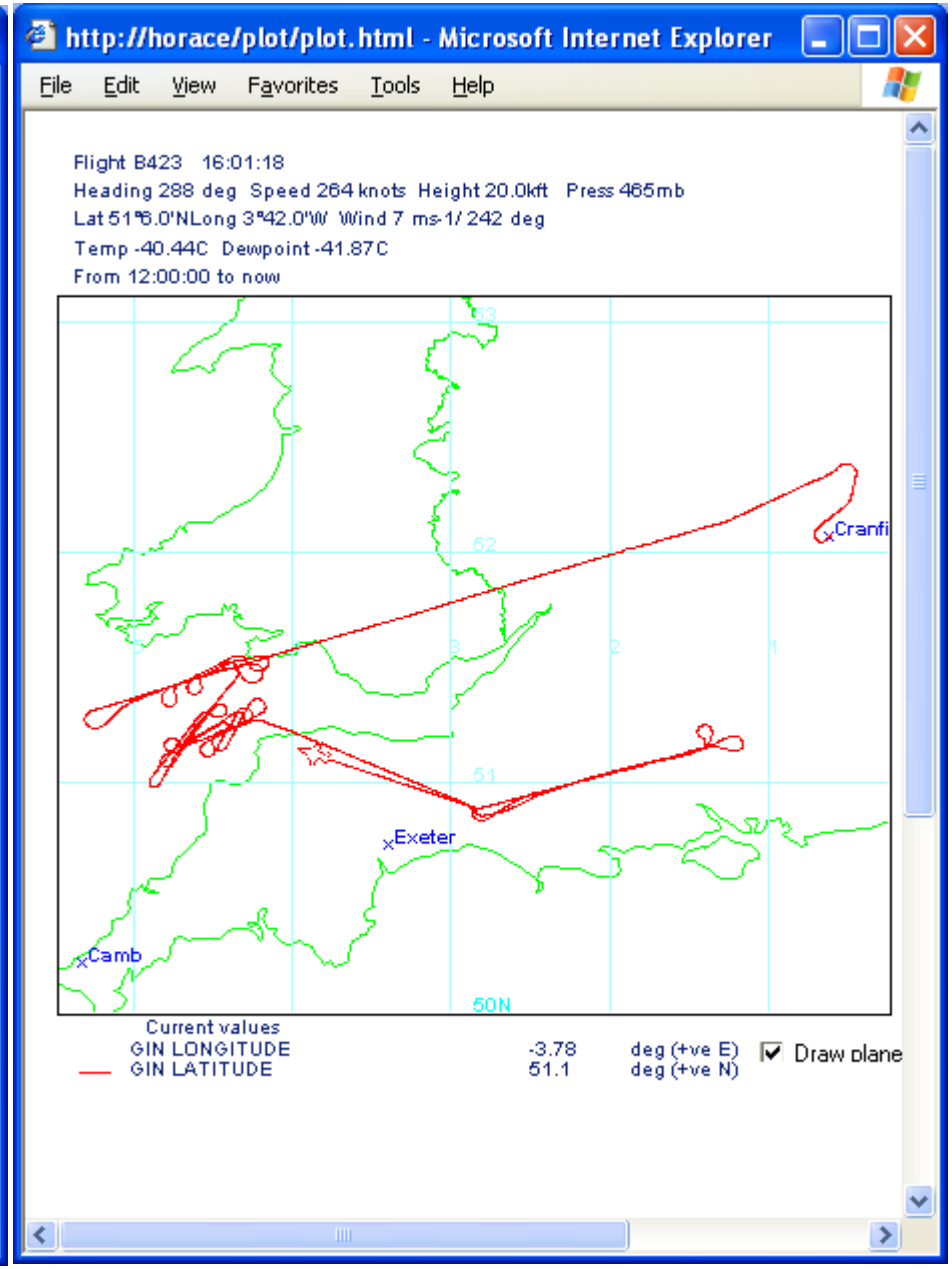




Turning - heading for Ci towards NW

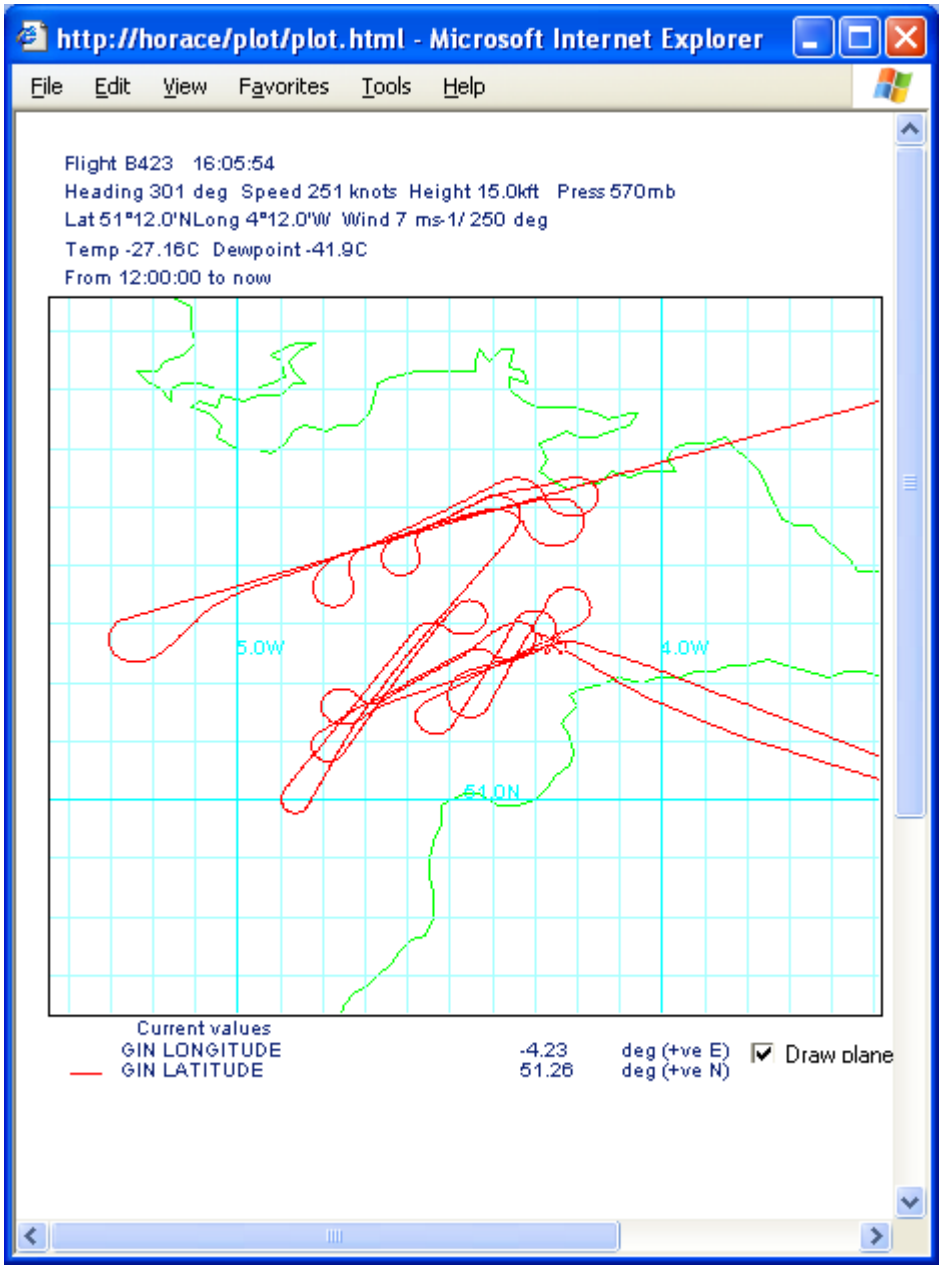
Out of Ci anvil (into another soon)



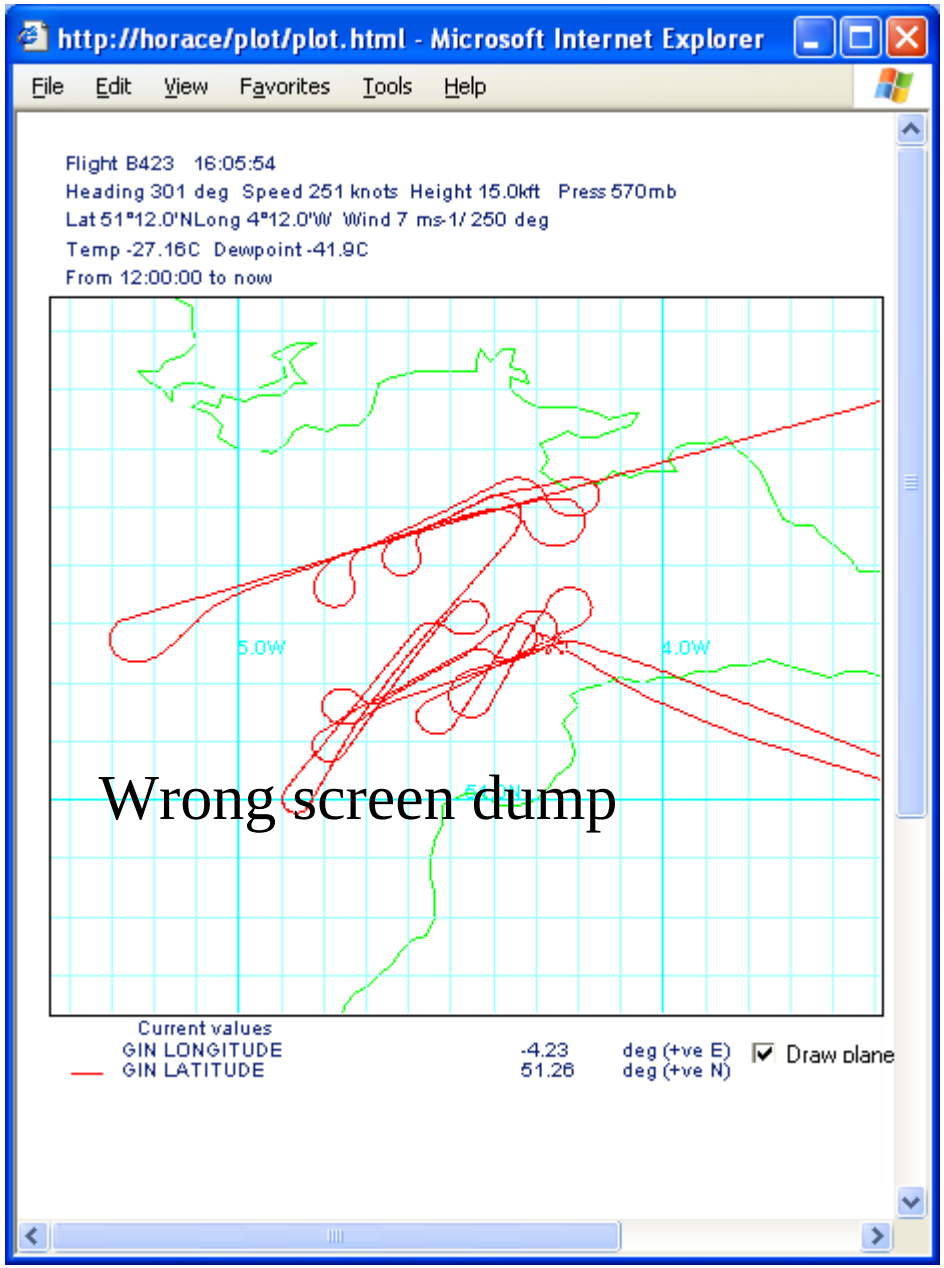


Into more Ci - anvil outflow

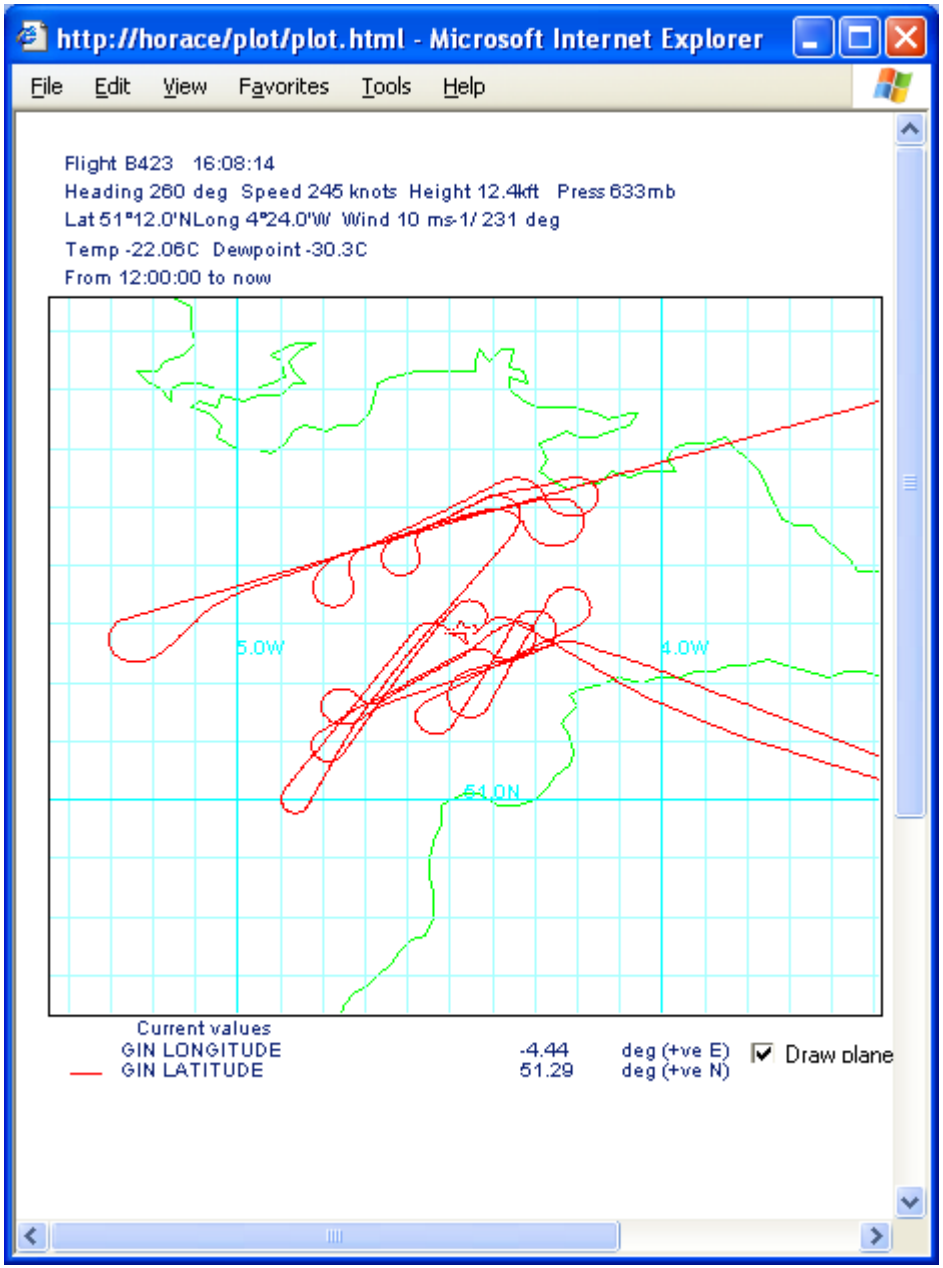
End R17, start P17

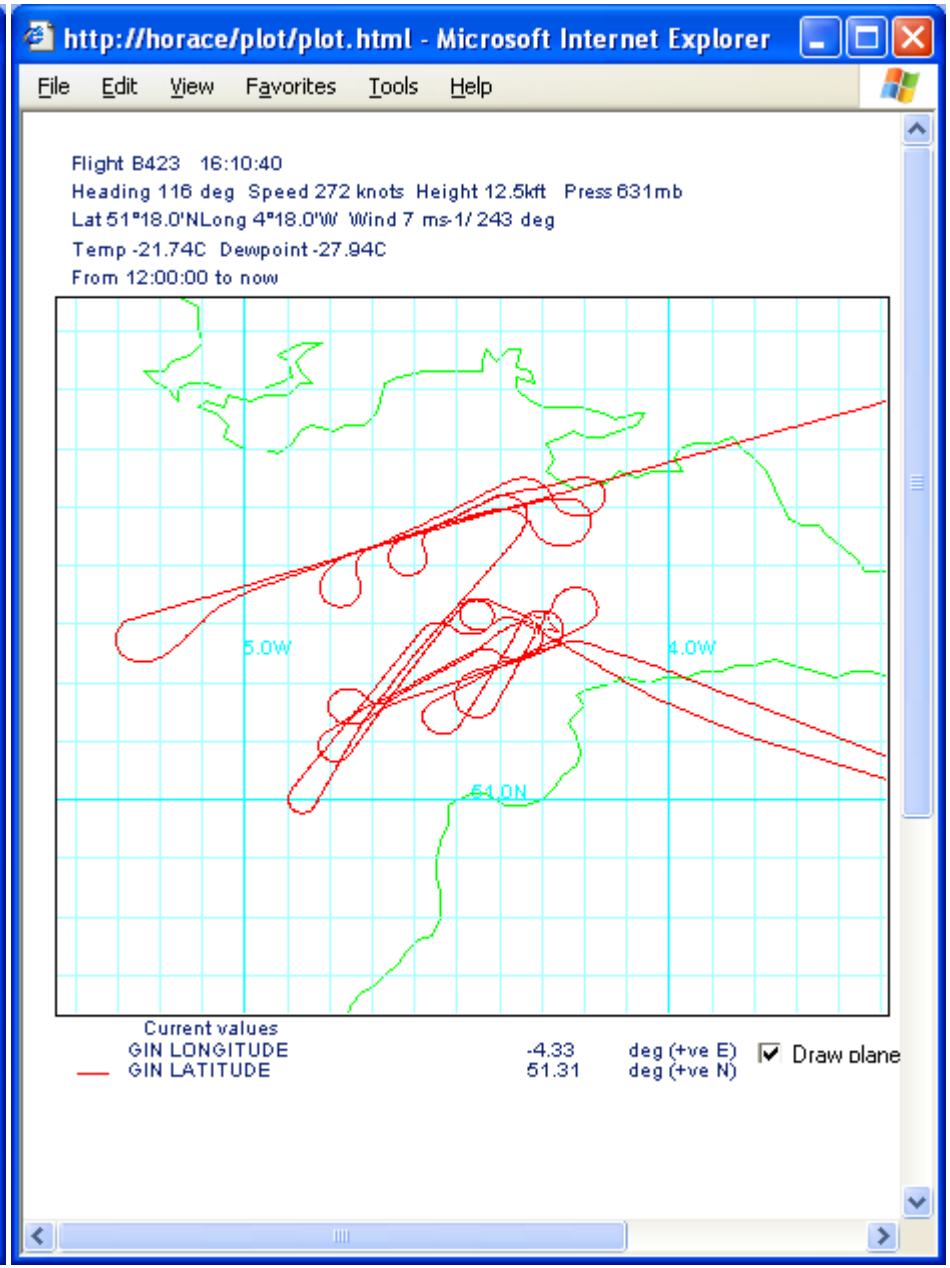


Cloud on P17



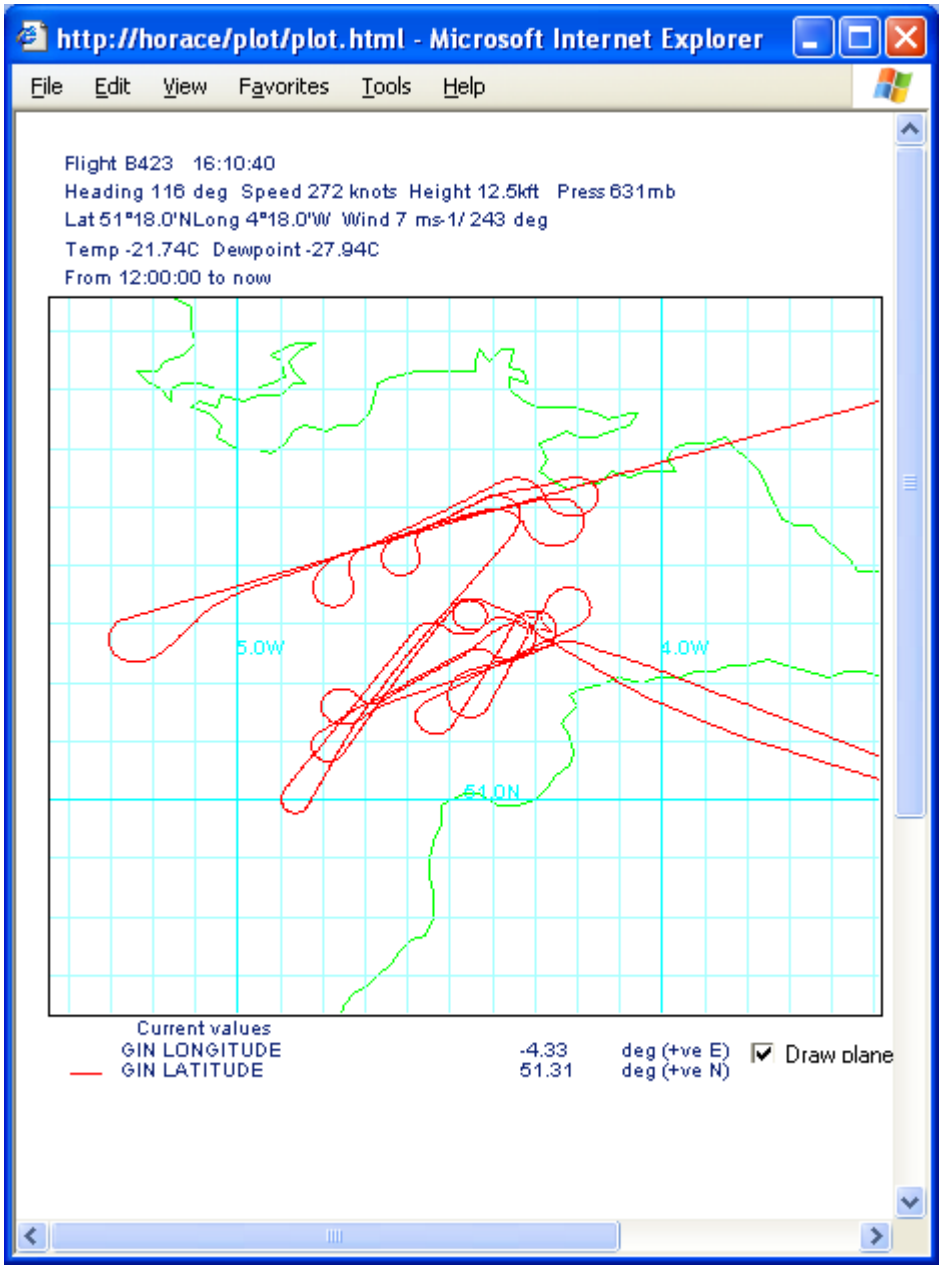
Out of cloud



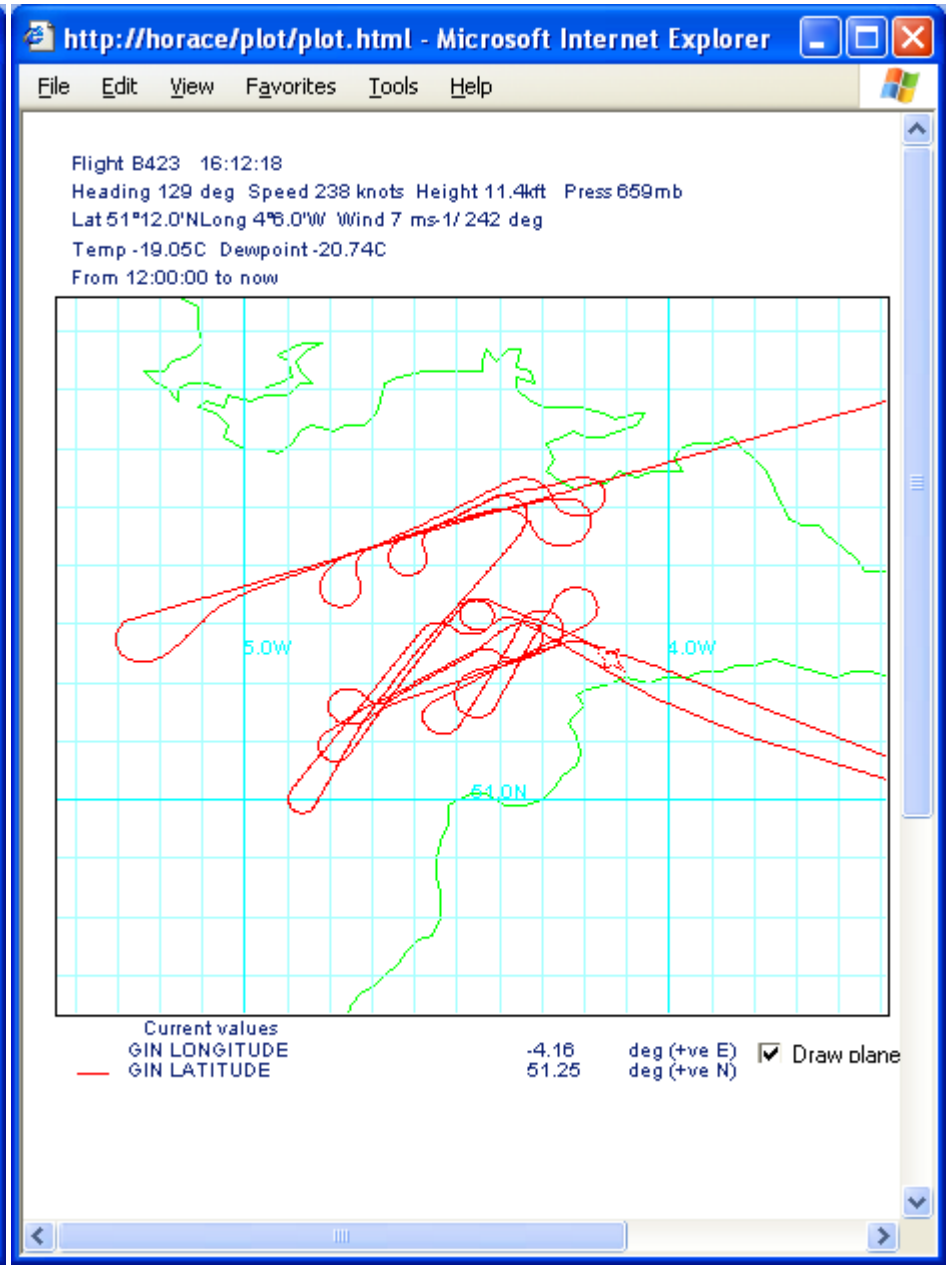


P17 int at 12000ft

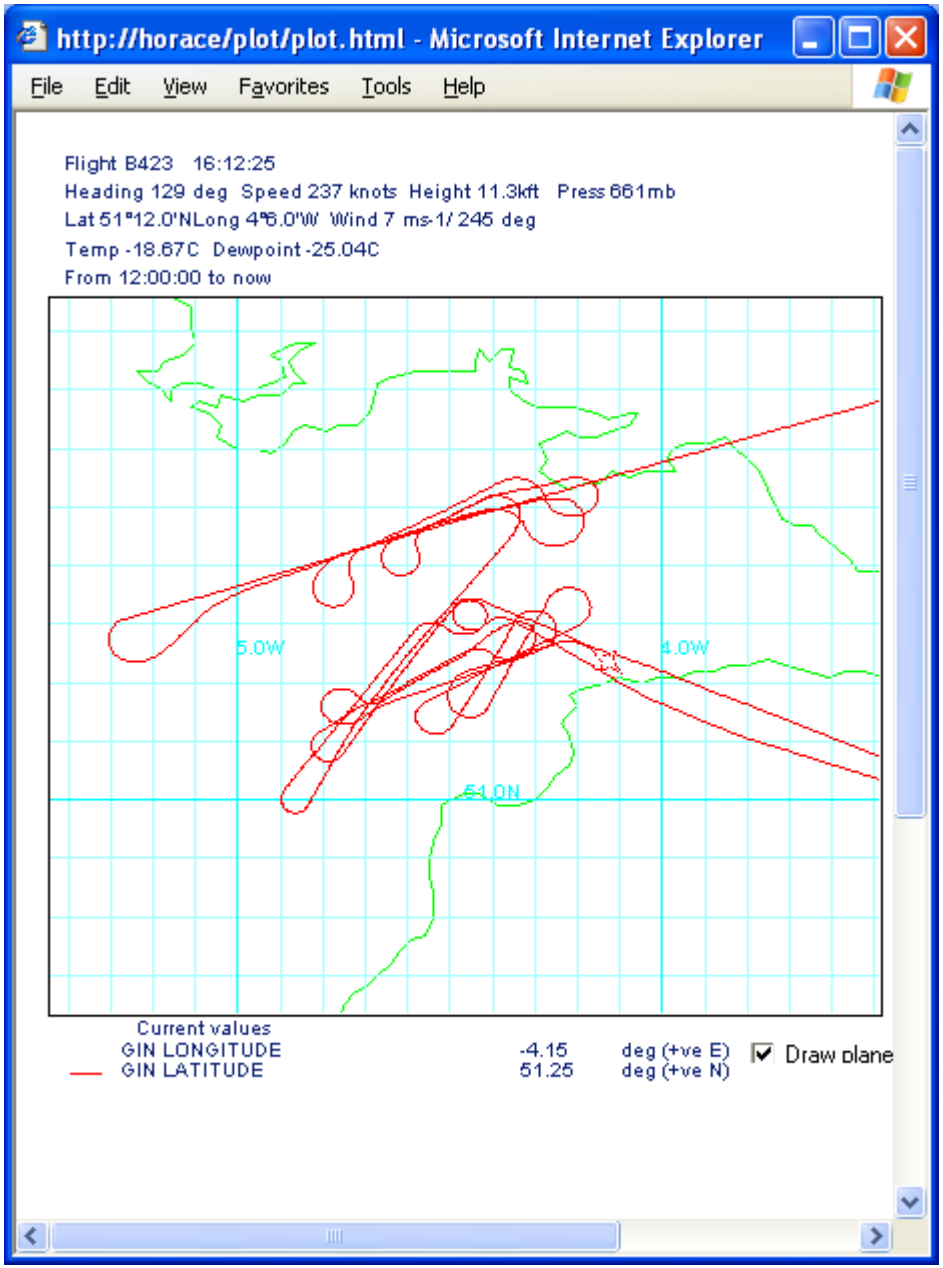
P17 rec



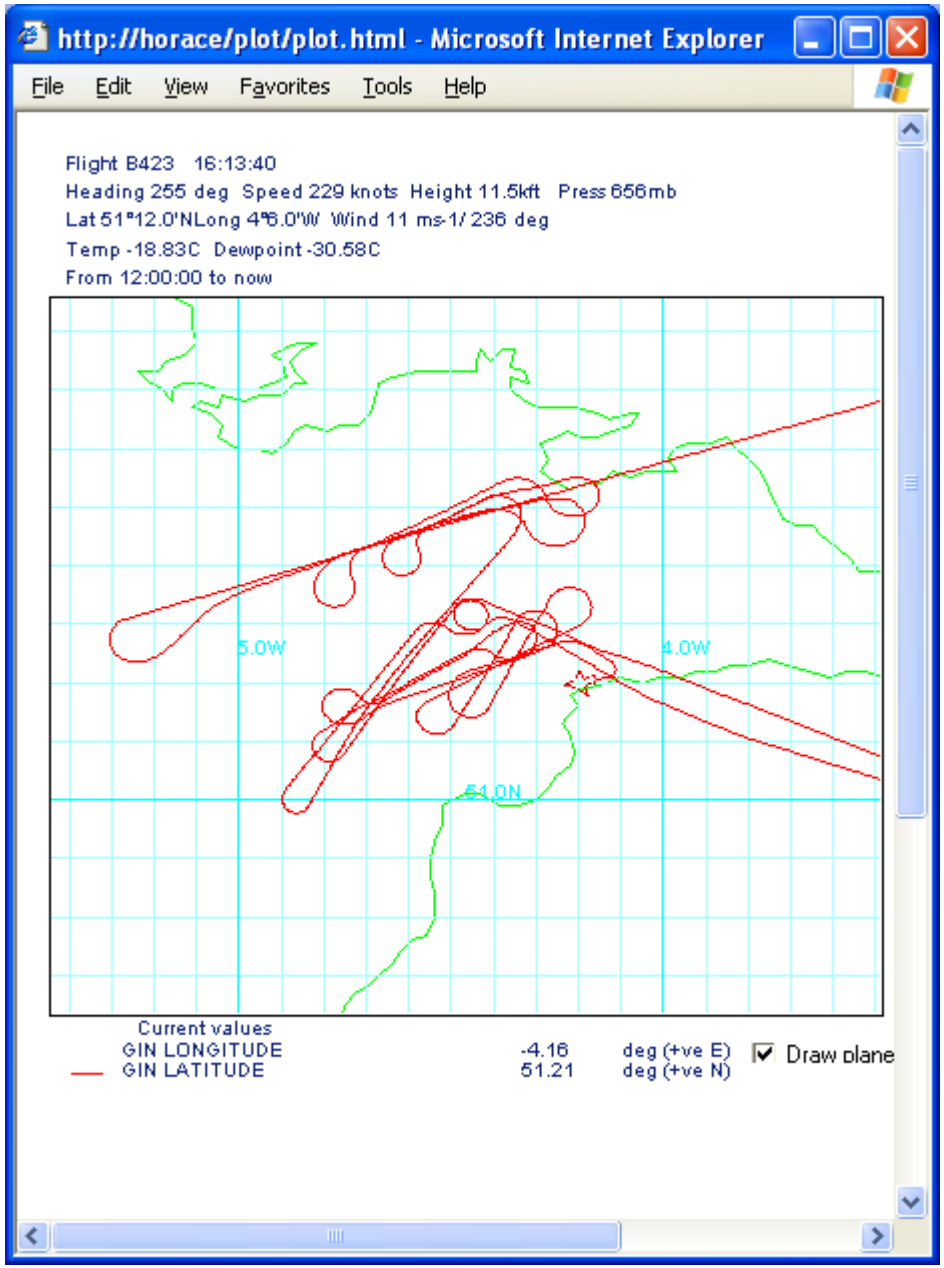
Cloud P17



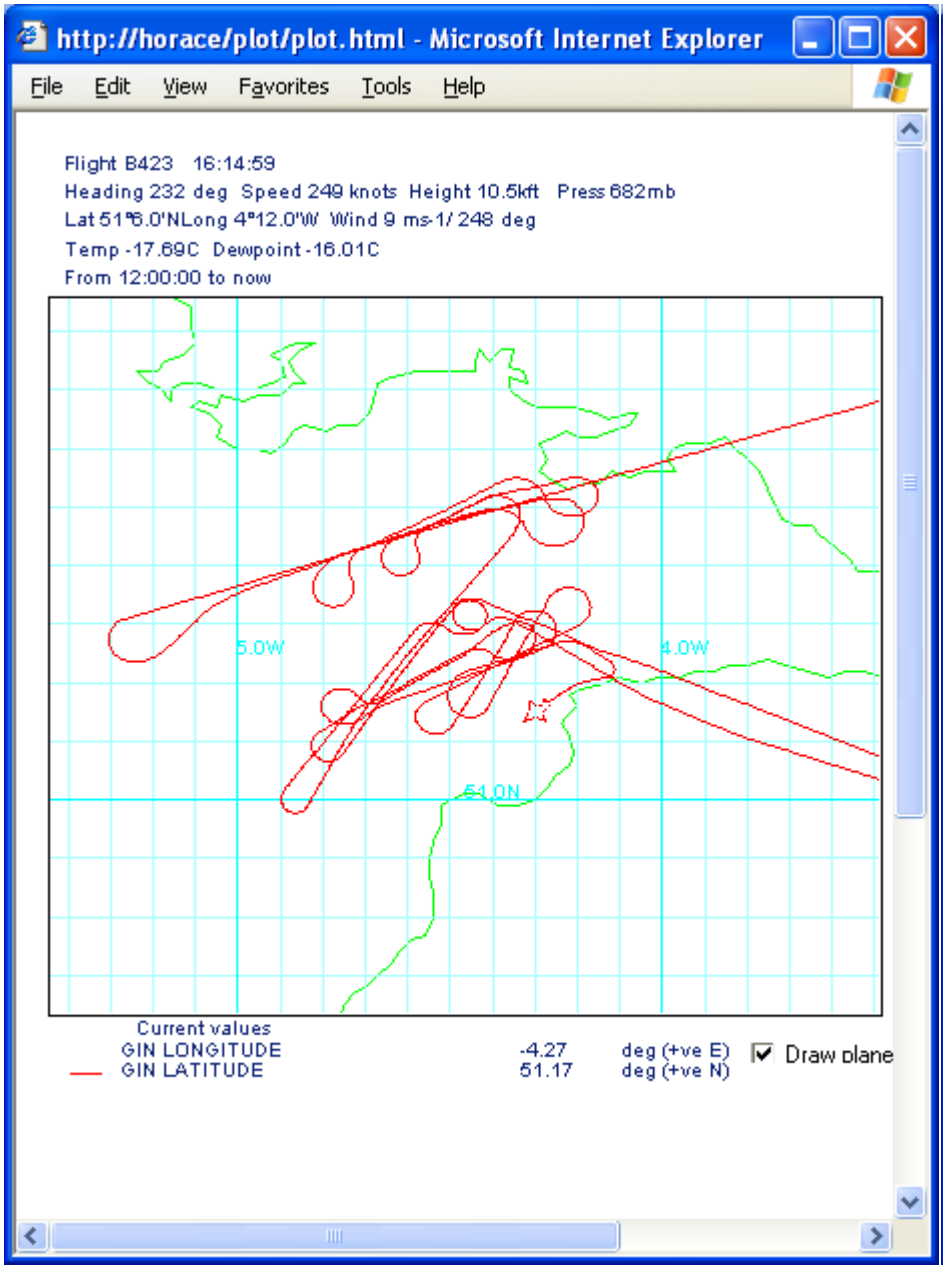
No cloud

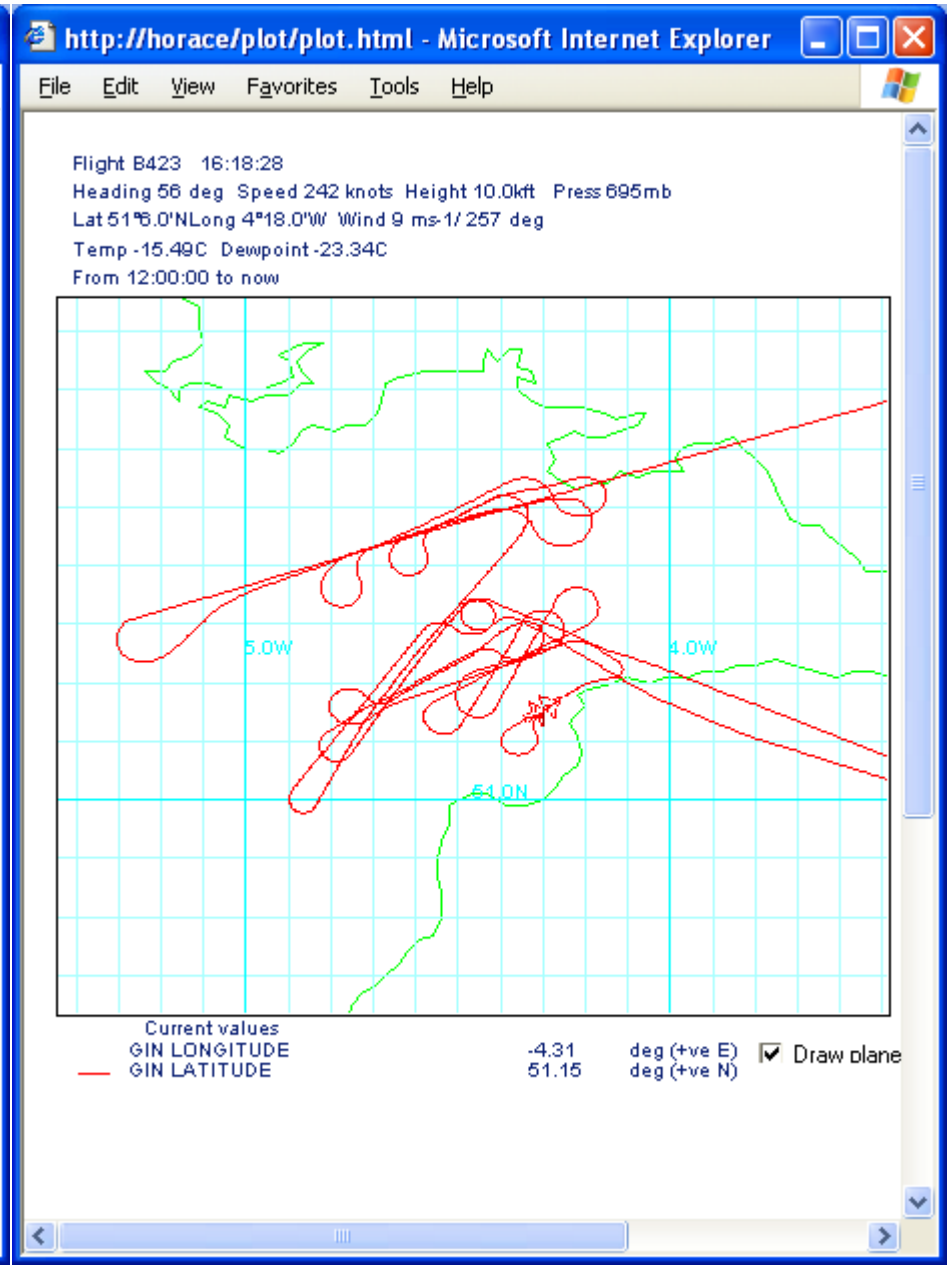


P17 int



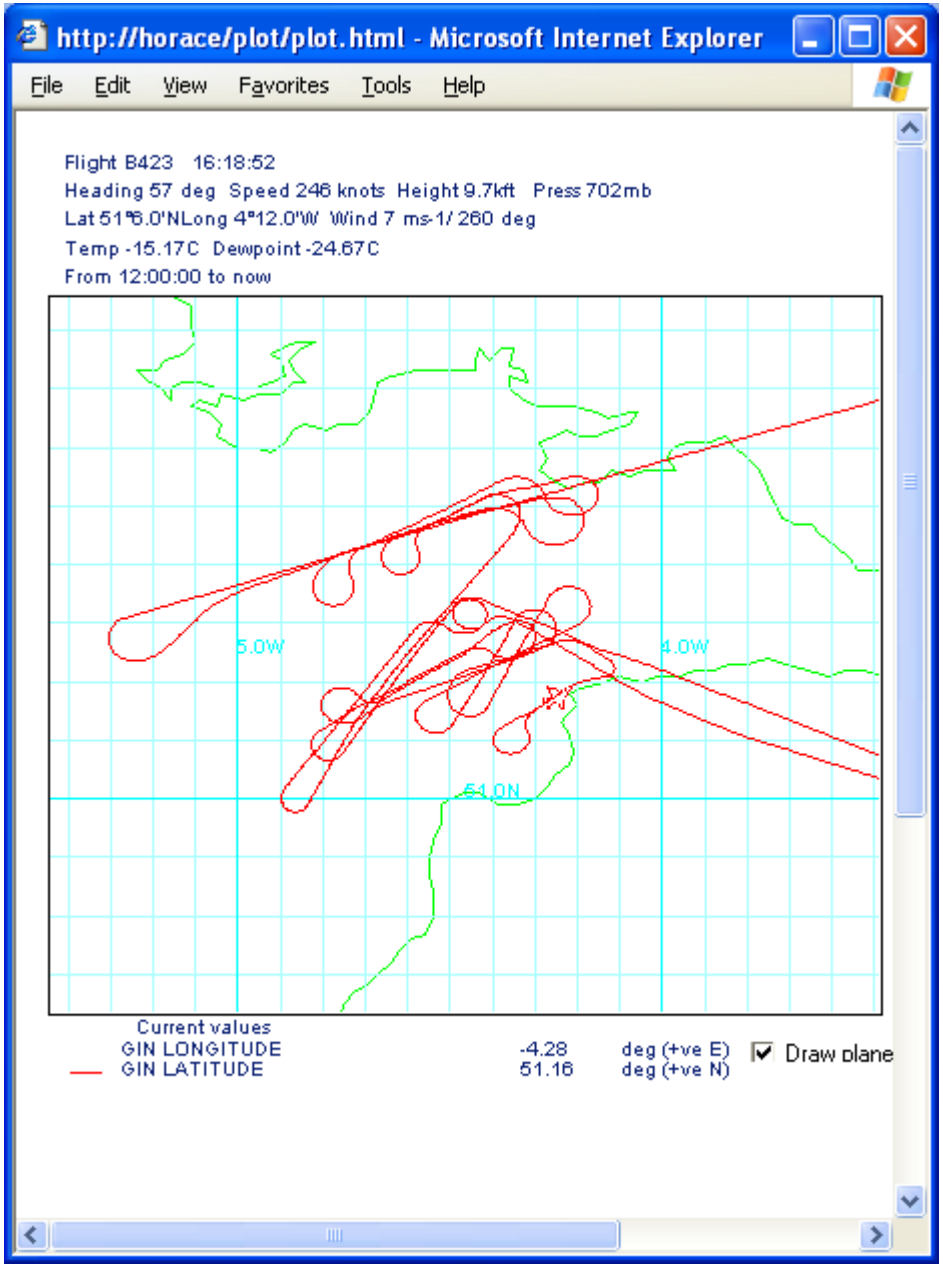
P17 rec

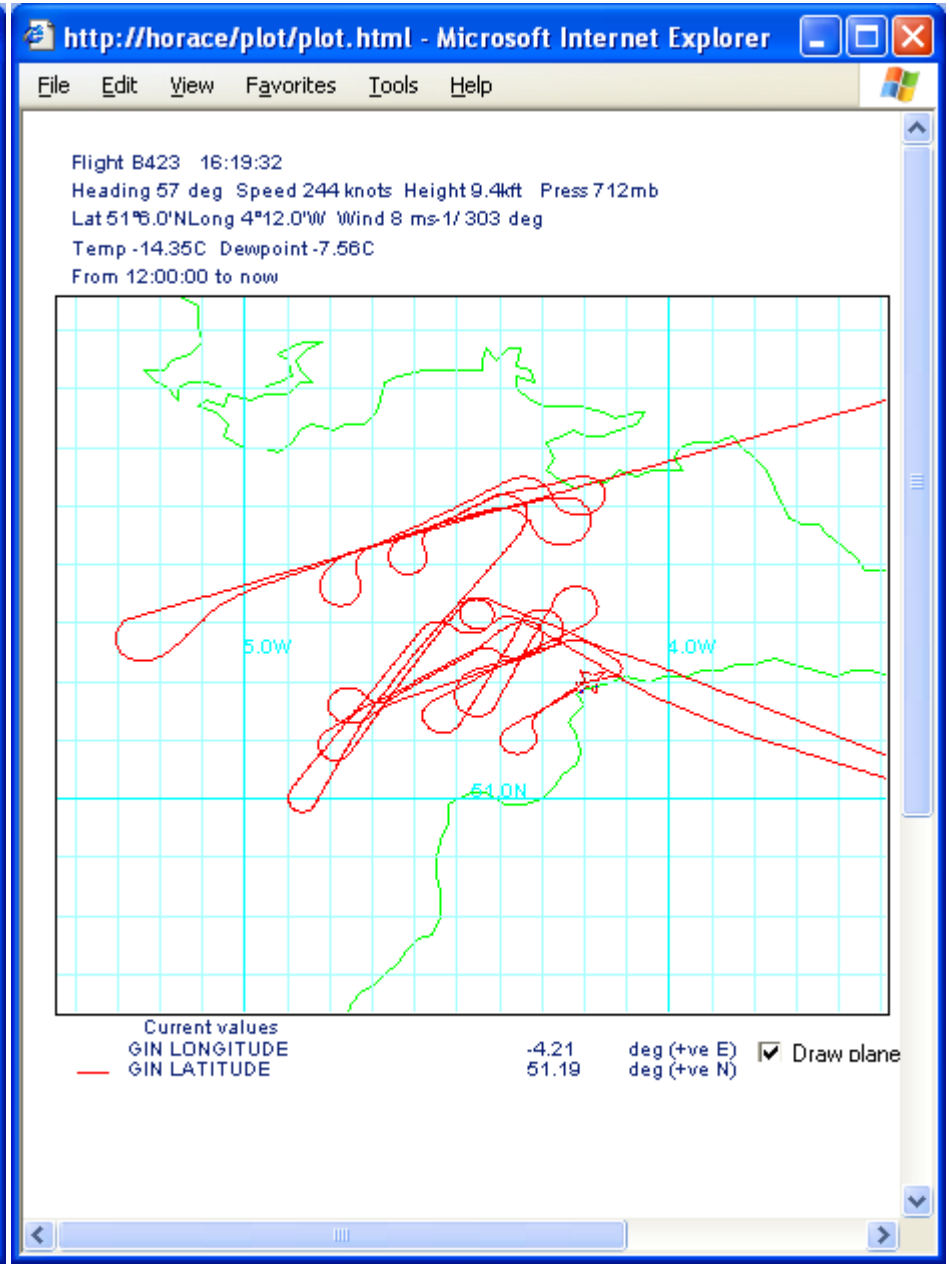




Just out of cloud - P17 int hard ppt near edge

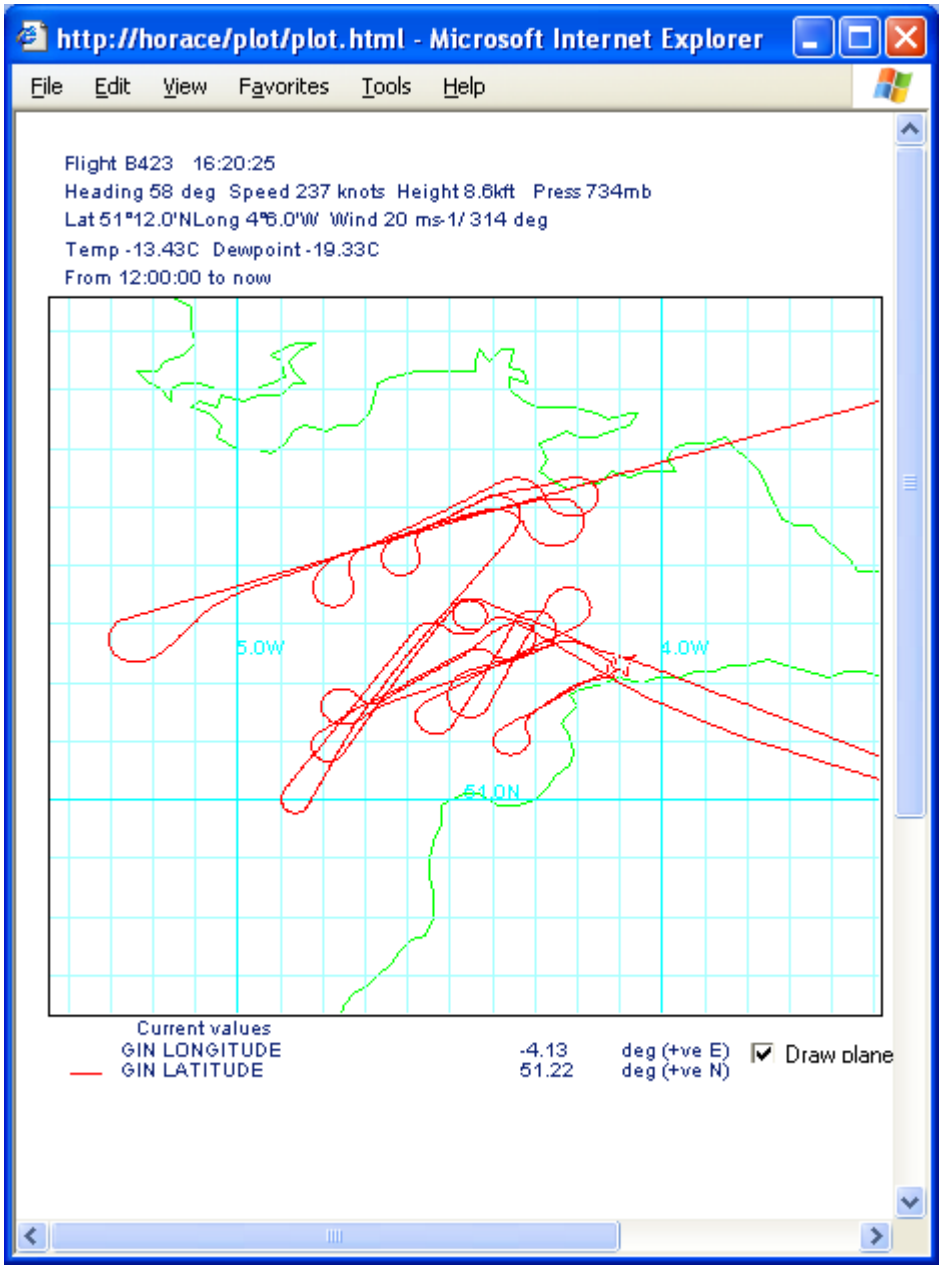
P17 rec



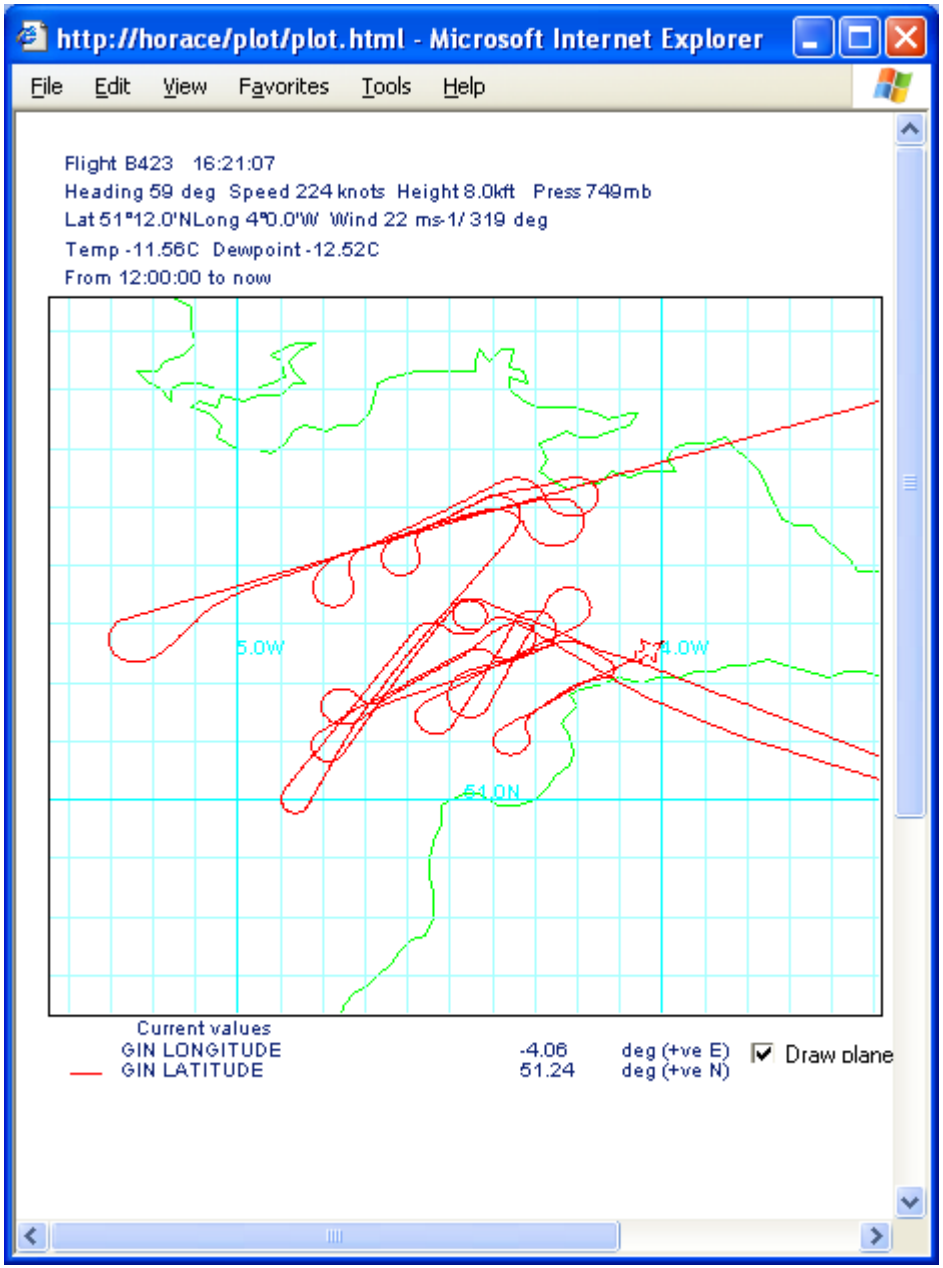


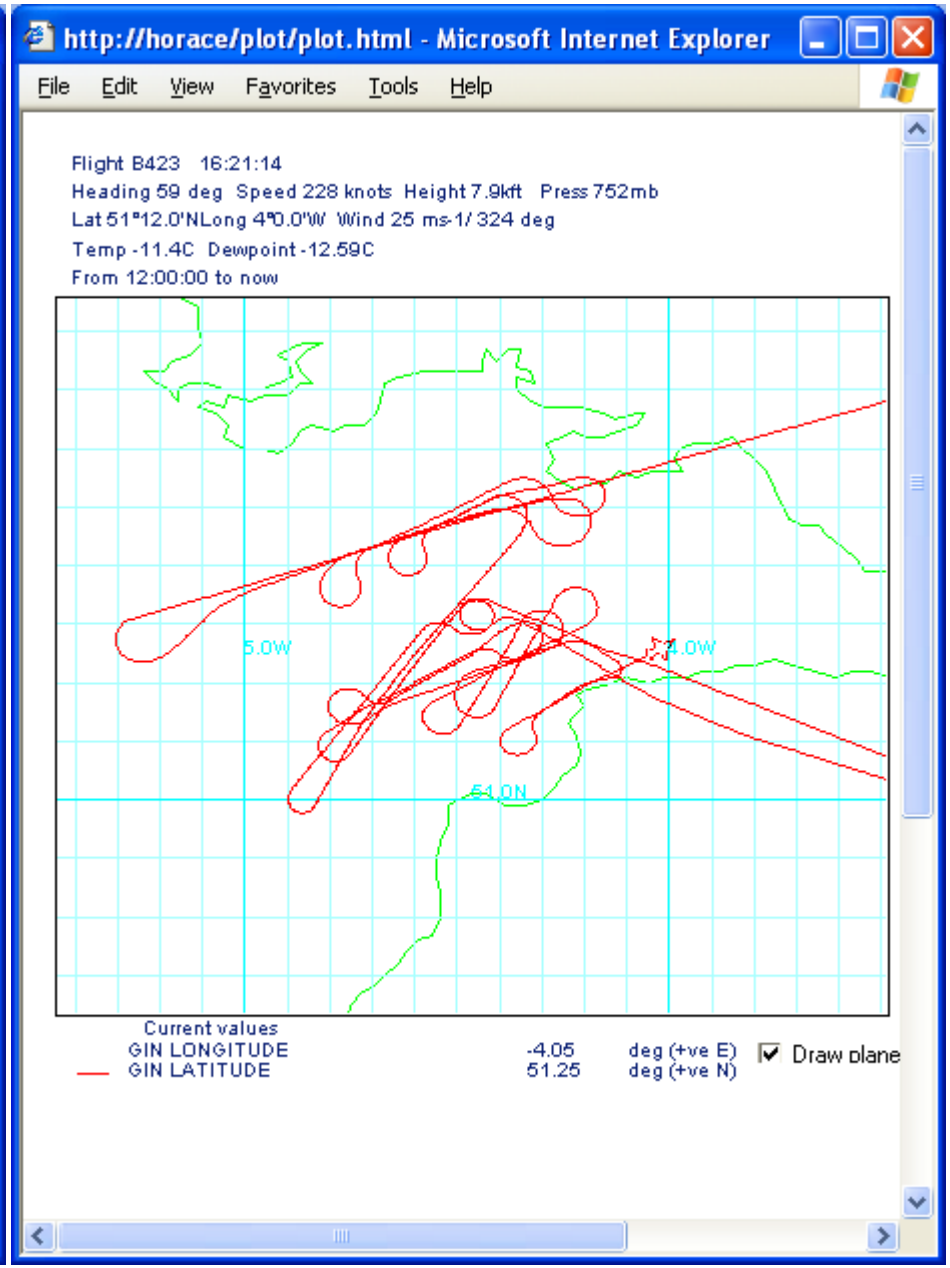
cloud - ppt and bumpy

Huge ppt



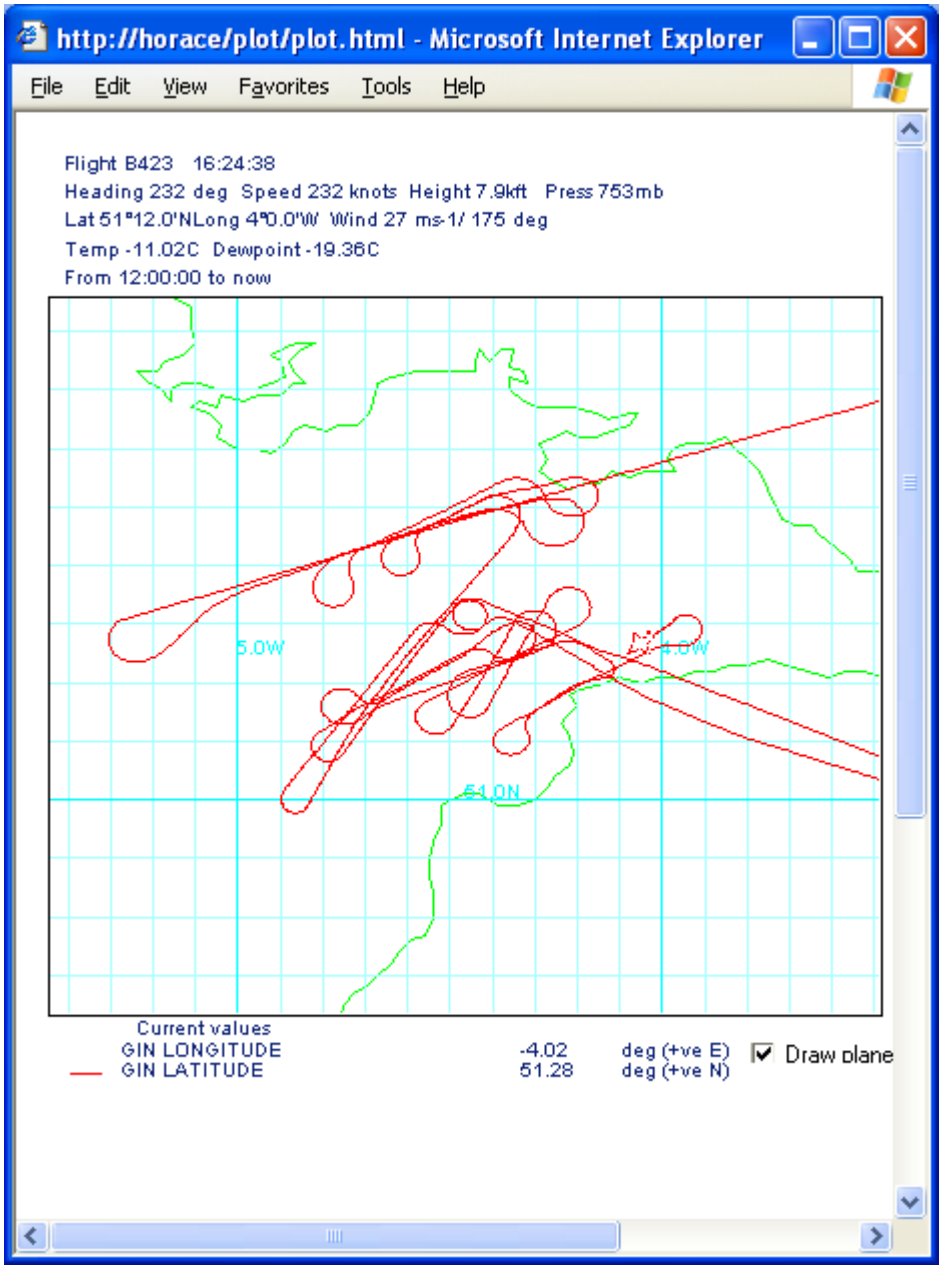
Out of main cloud - now shoulders feeding it

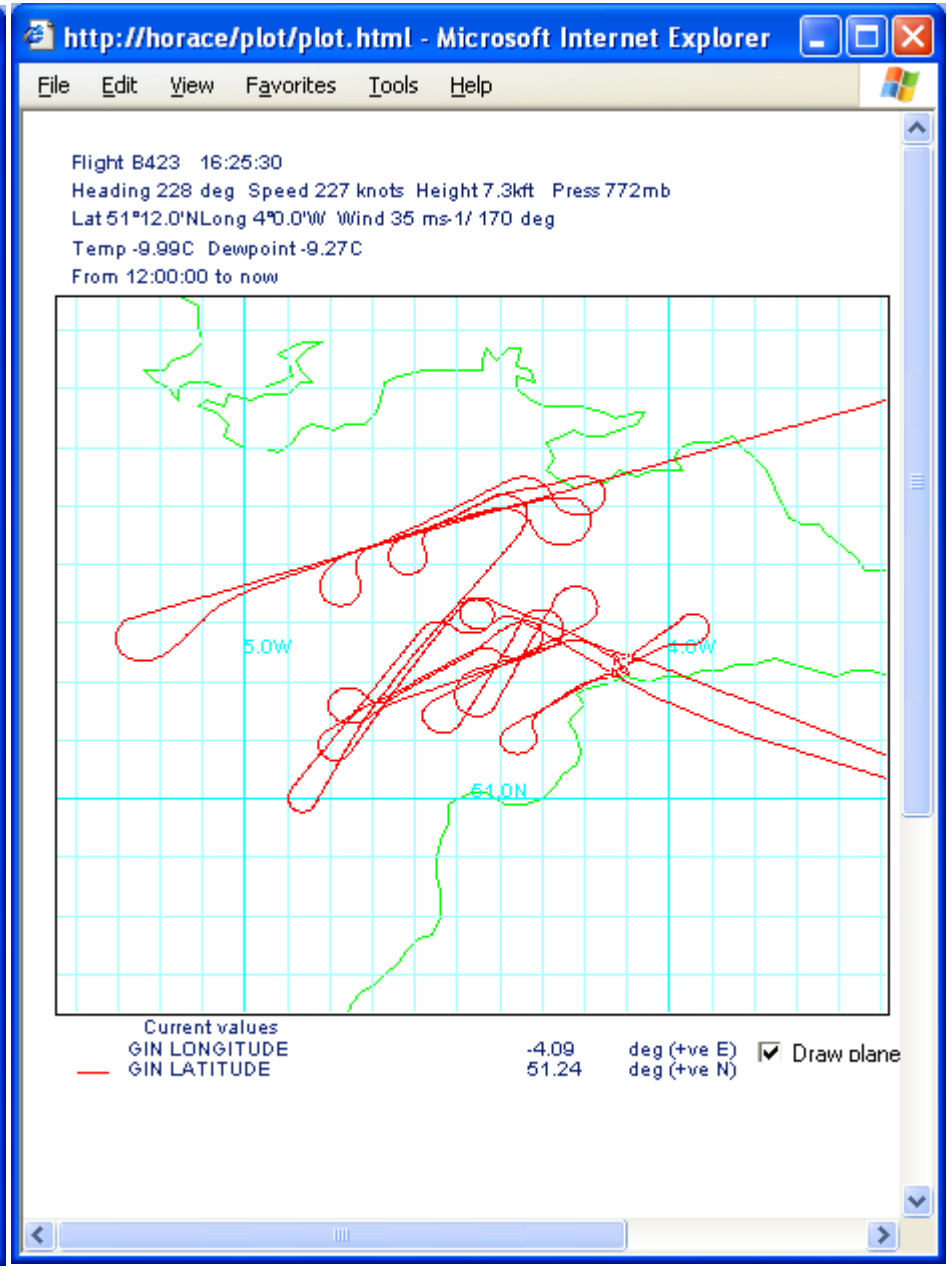




Out of cloud

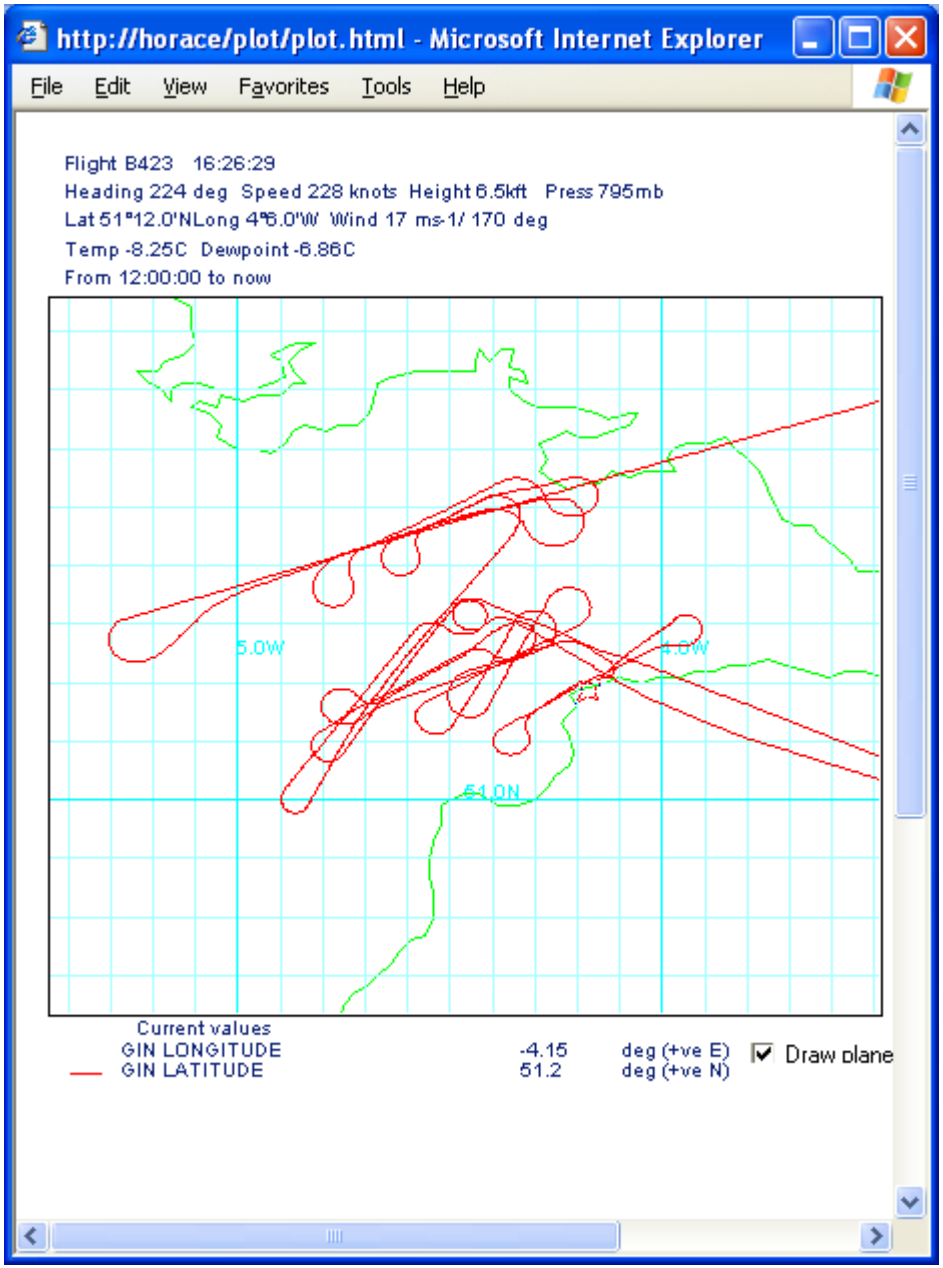
P17 int

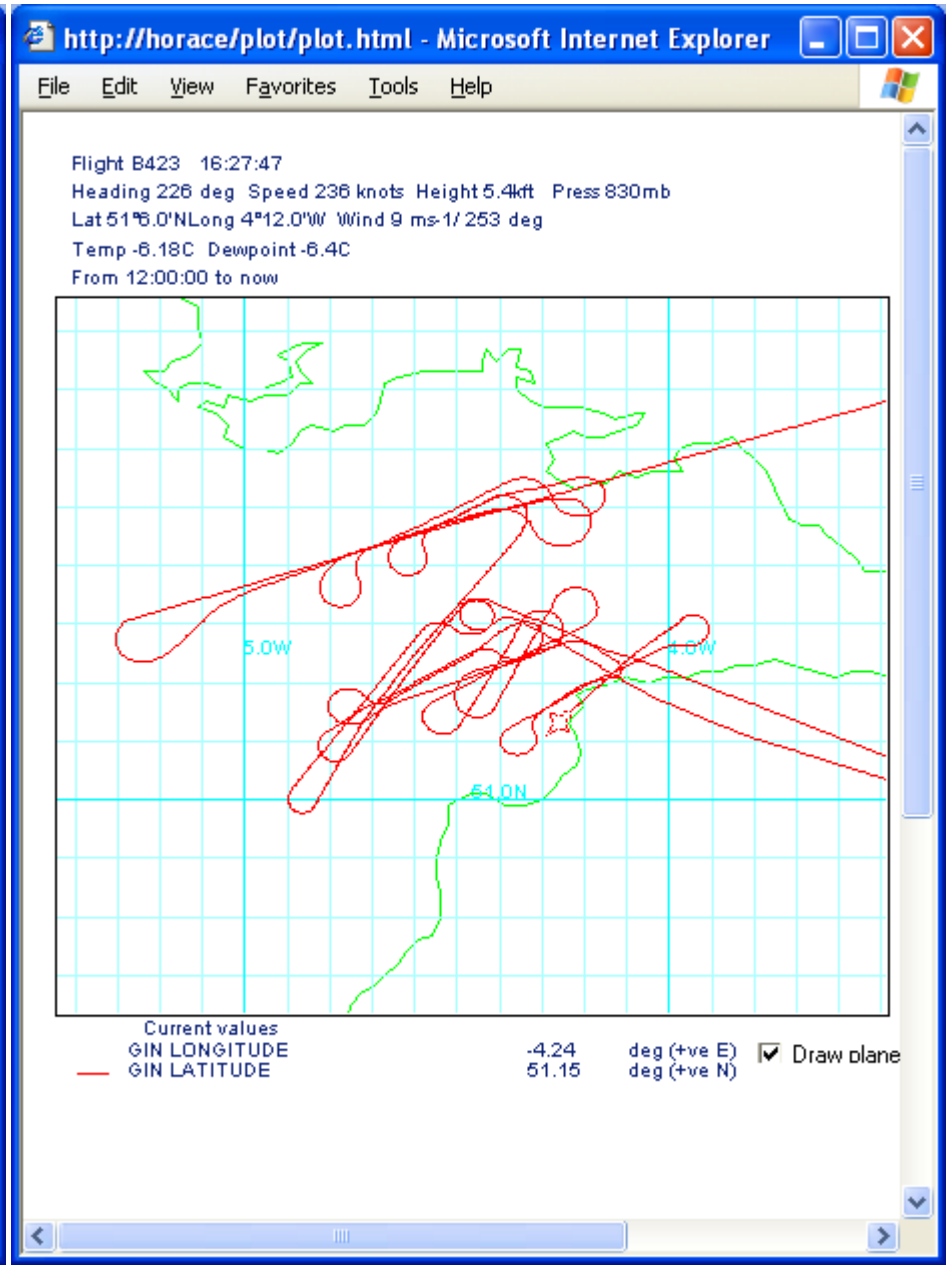




P17 rec

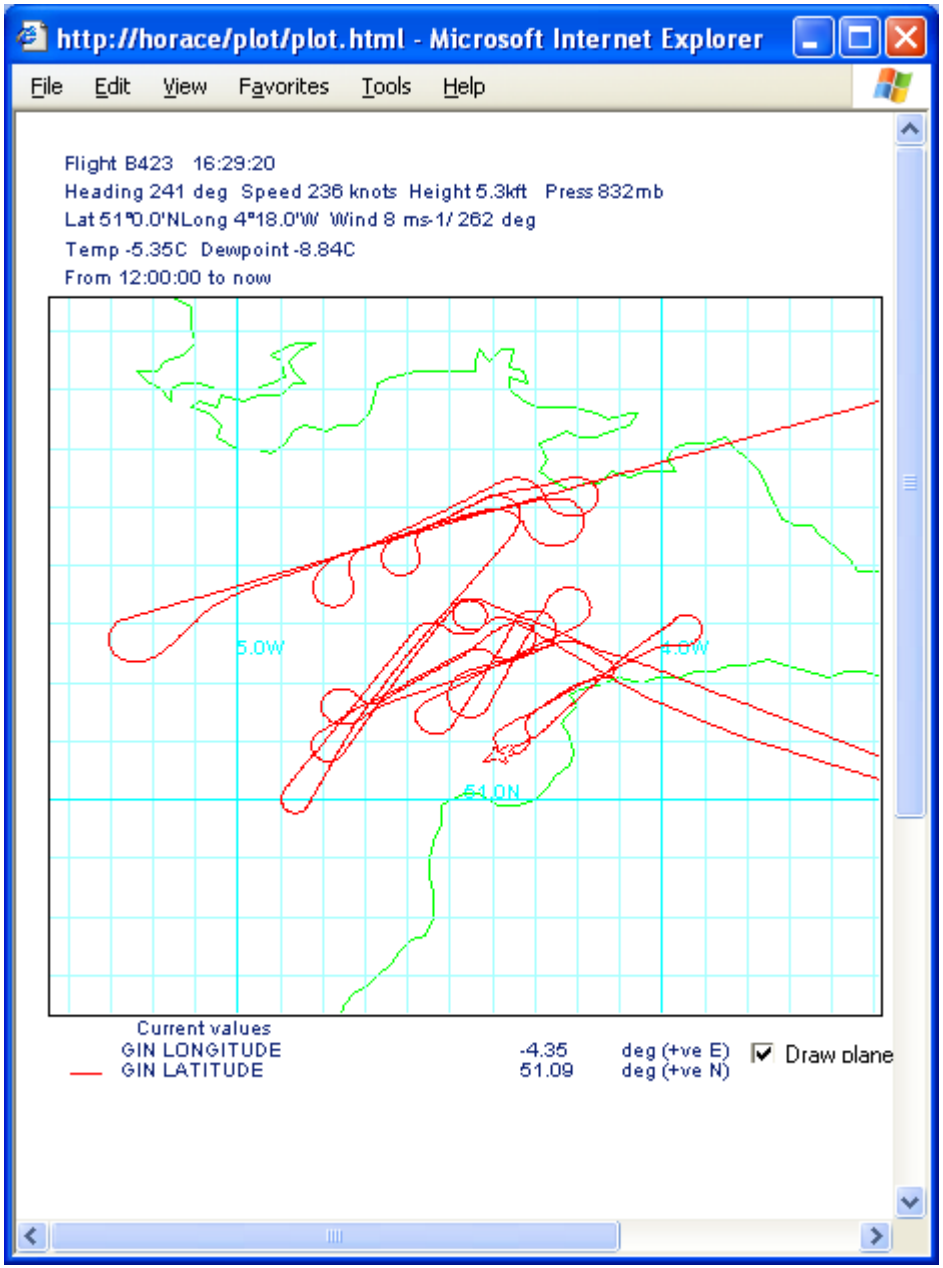
Still in shoulders

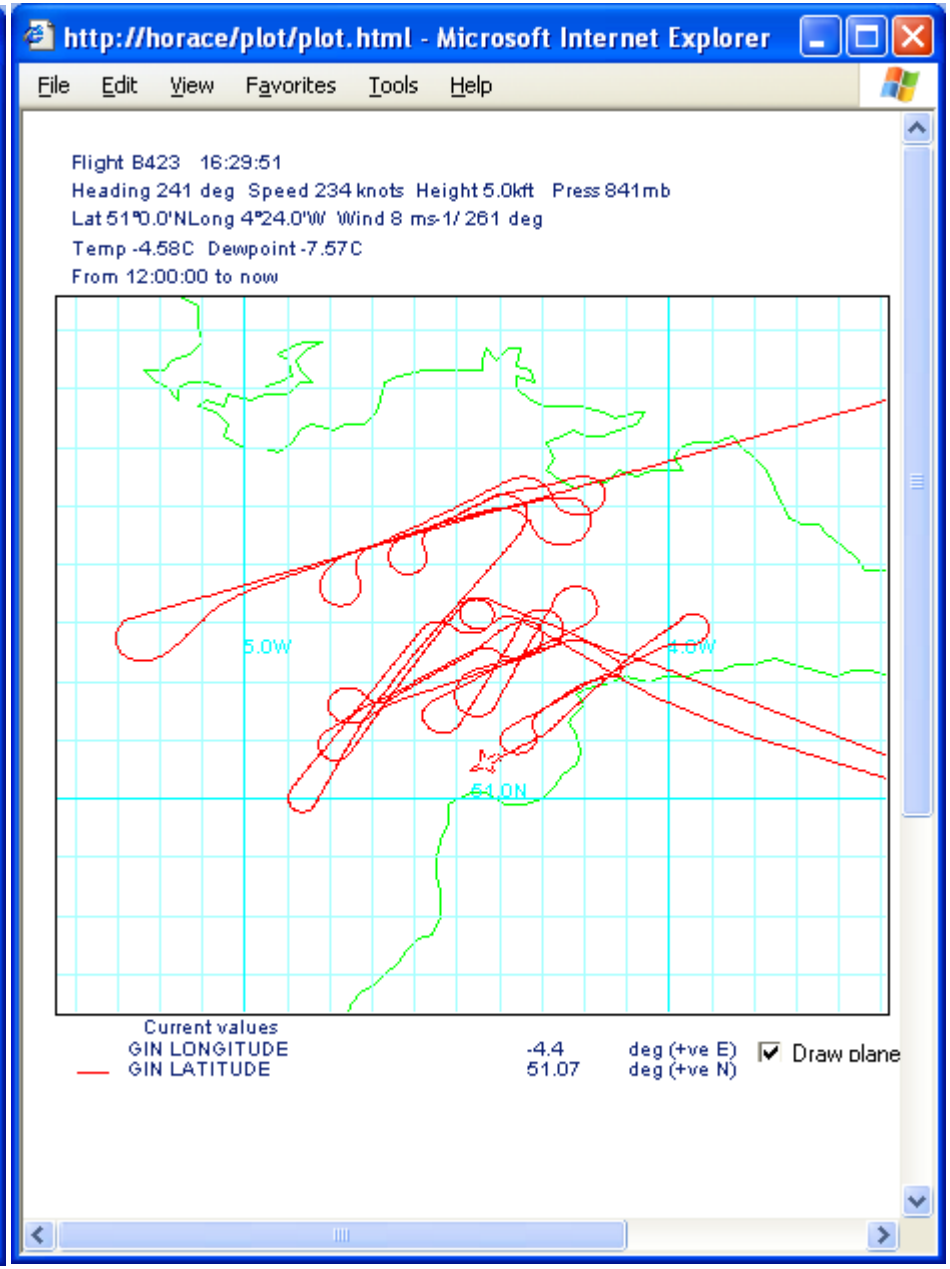




Bumpy - lightning strike - Wow

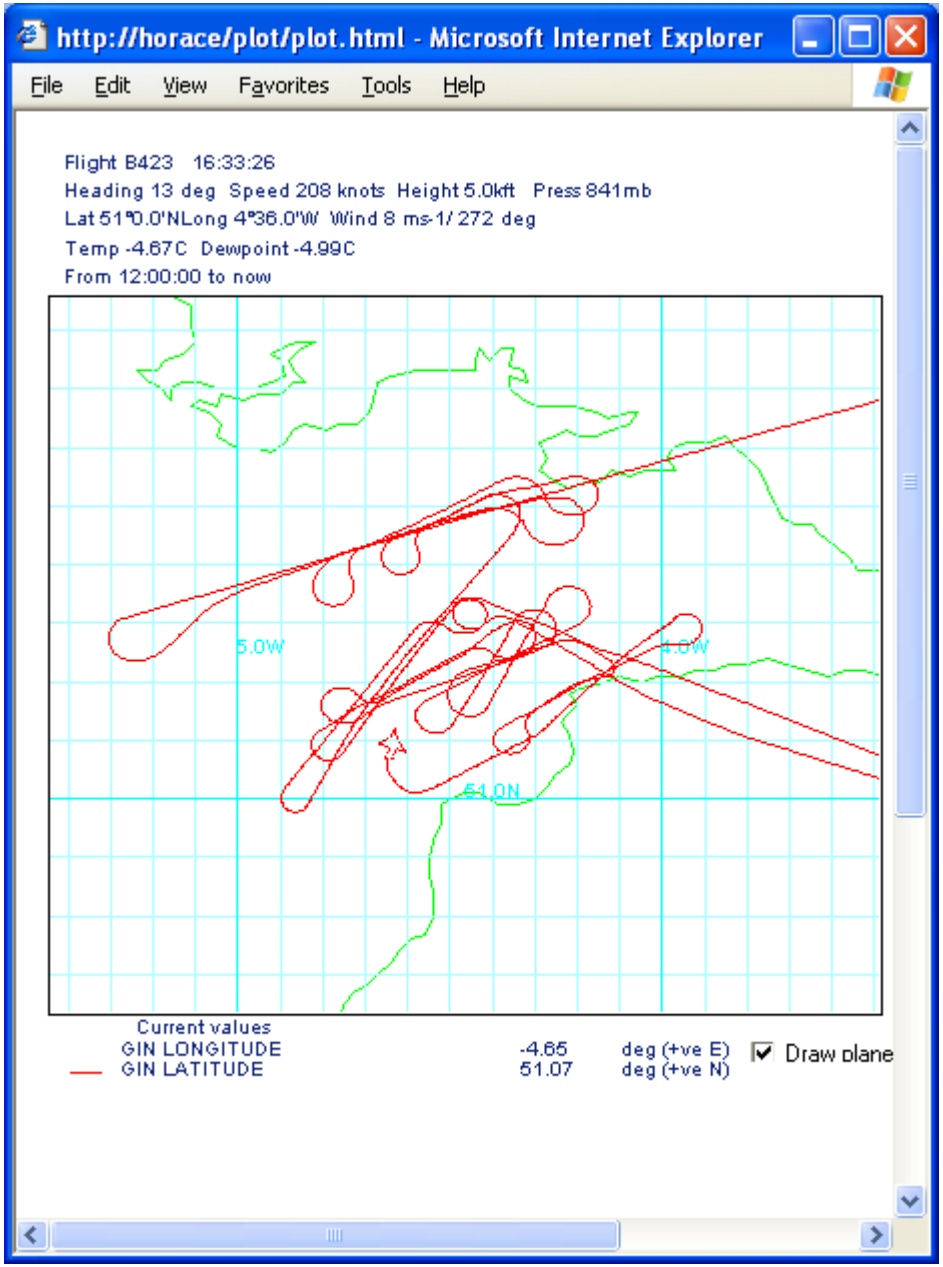
[(Q) ….. Out of cloud ???]



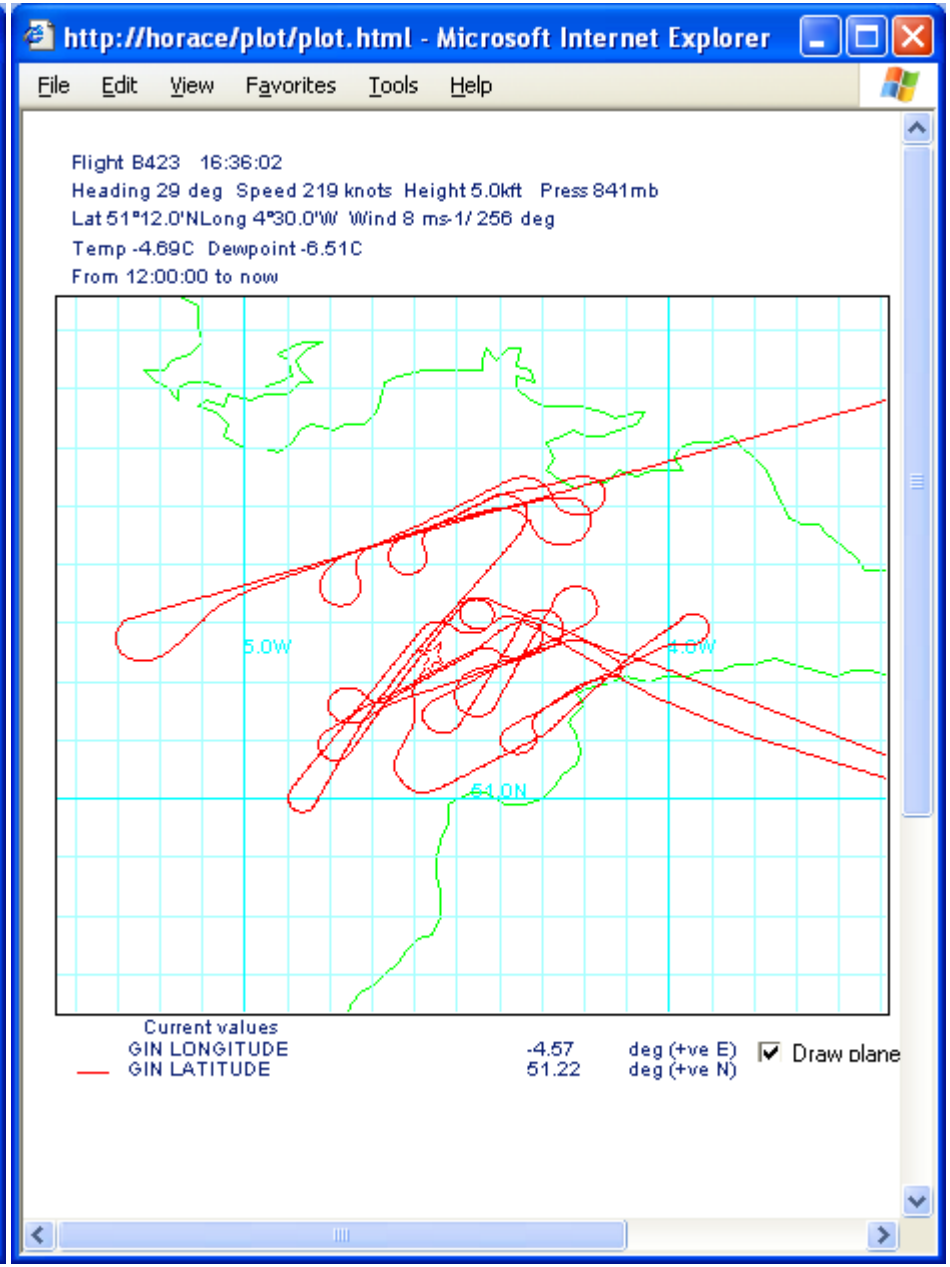


Rec P17 down to 44 on 990mb setting

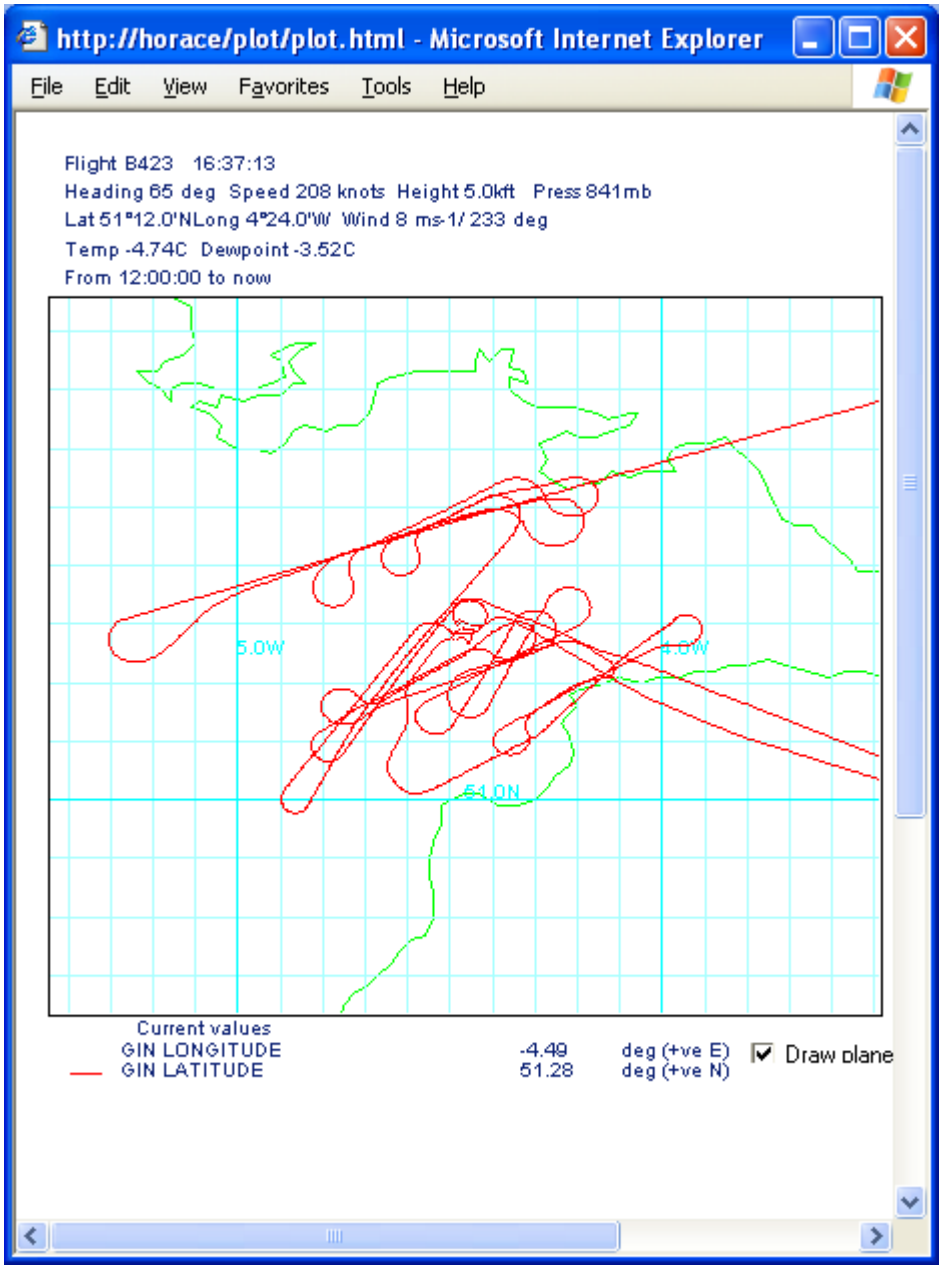
End P17 start R18 5kft



R18 cloud



R18 cloud



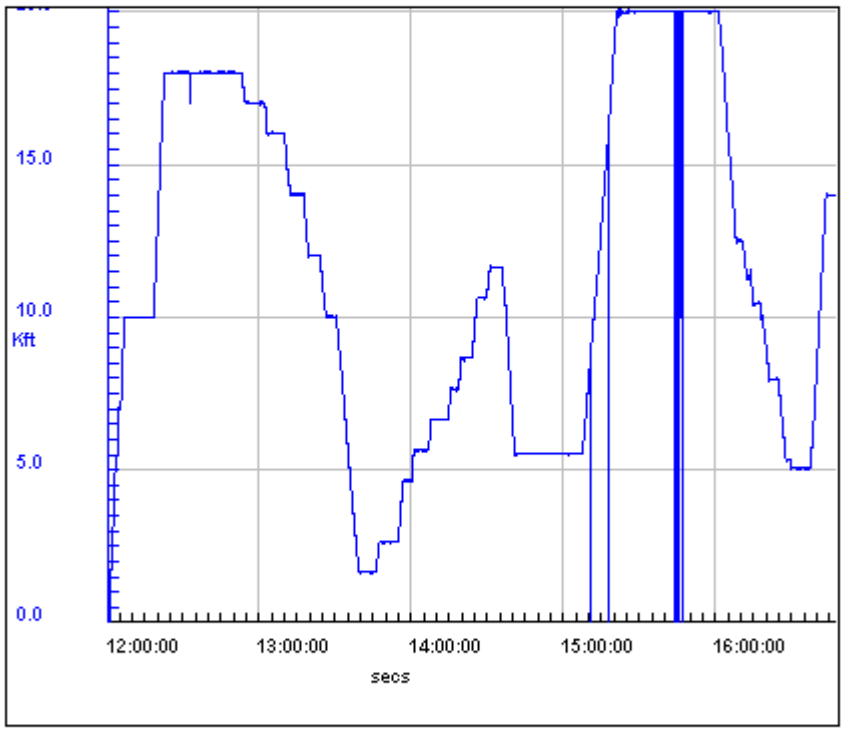
End R18 start profile 18

http://horace/plot/plot.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

New plot, same times

Flight B423 16:47:31
Heading 70 deg Speed 267 knots Height 14.0kft Press 595mb
Lat 51°36.0'NLong 3°24.0'W Wind 6 ms-1/ 227 deg
Temp -24.11C Dewpoint -39.22C
From 12:00:00 to now



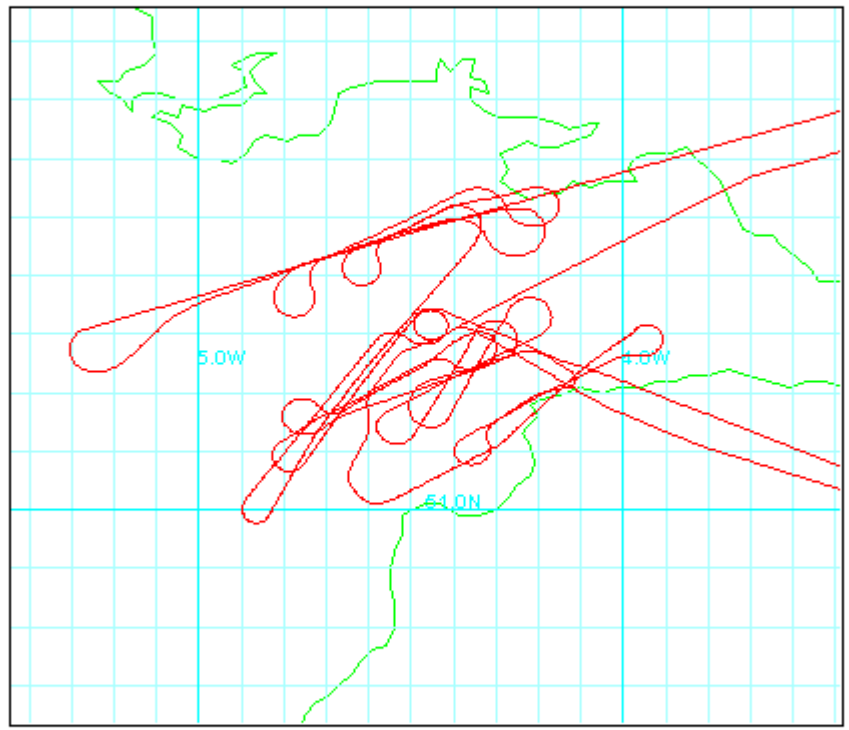
Current values

TIME FROM MIDNIGHT	60450	secs	All	sc
PRESSURE HEIGHT	14	Kft		

http://horace/plot/plot.html - Microsoft Internet Explorer

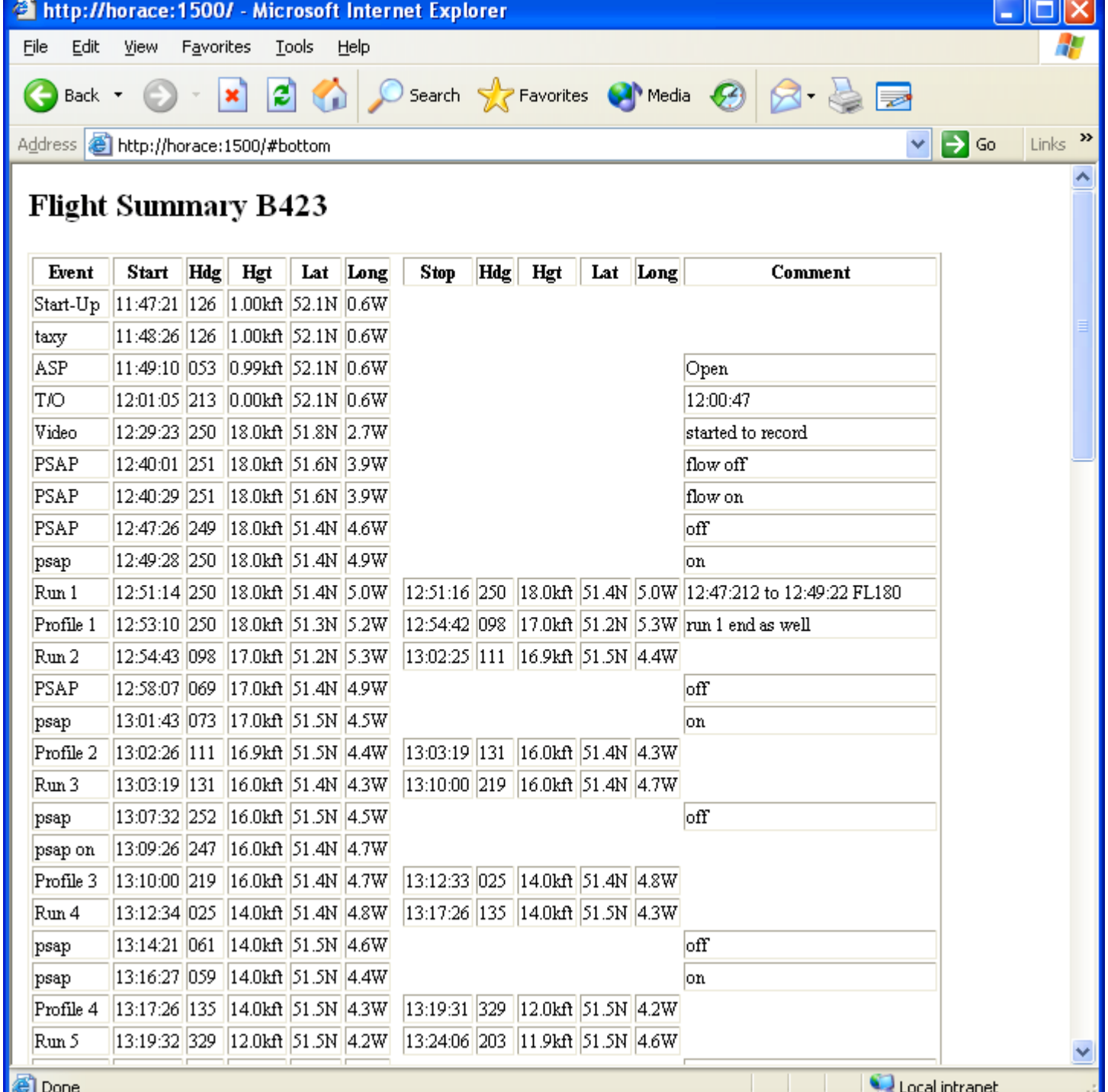
File Edit View Favorites Tools Help

Flight B423 16:47:58
Heading 71 deg Speed 266 knots Height 14.0kft Press 595mb
Lat 51°36.0'NLong 3°18.0'W Wind 7 ms-1/ 233 deg
Temp -24.02C Dewpoint -38.64C
From 12:00:00 to now



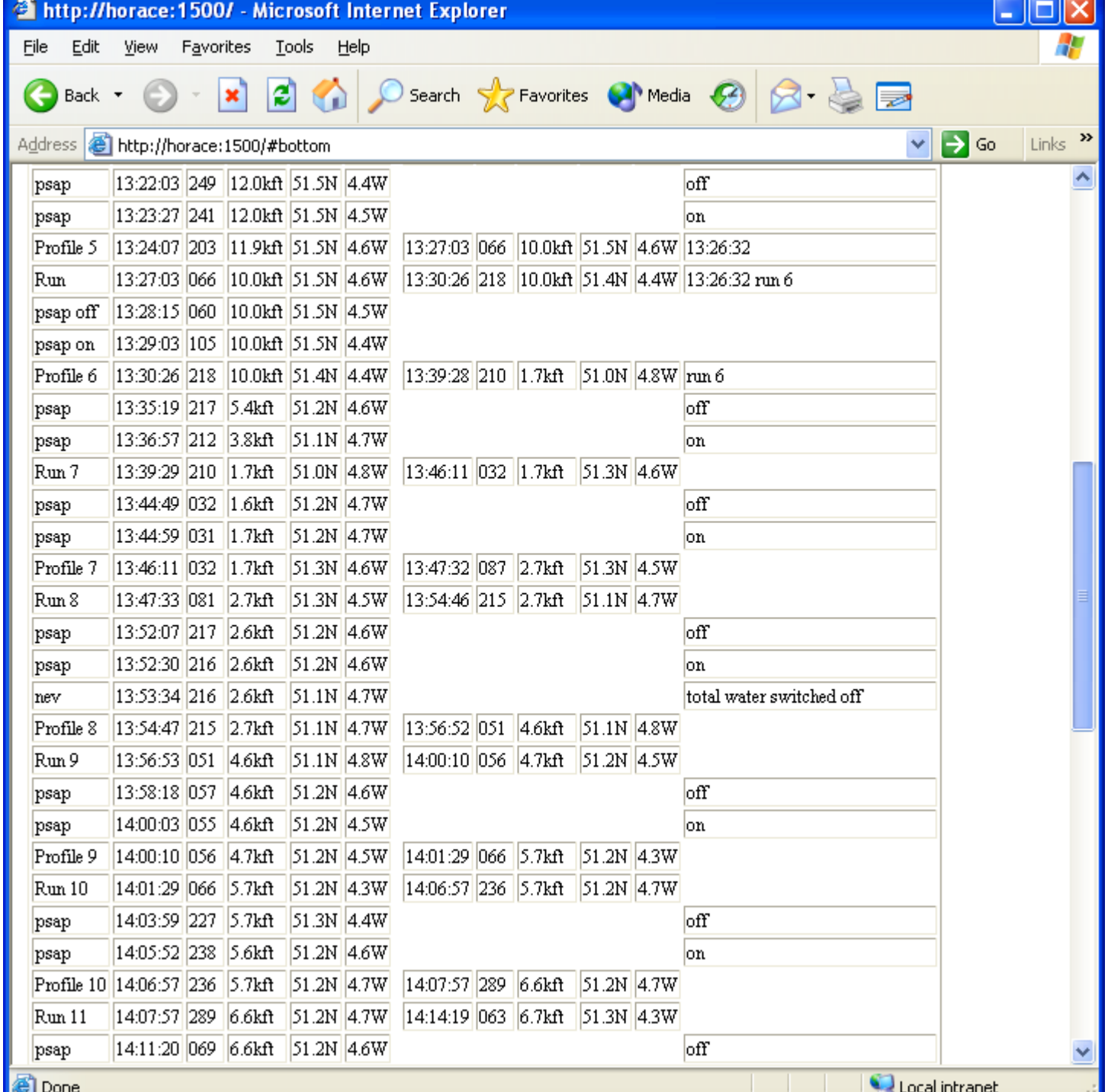
Current values

GIN LONGITUDE	-3.38	deg (+ve E)	Draw plane
GIN LATITUDE	51.64	deg (+ve N)	

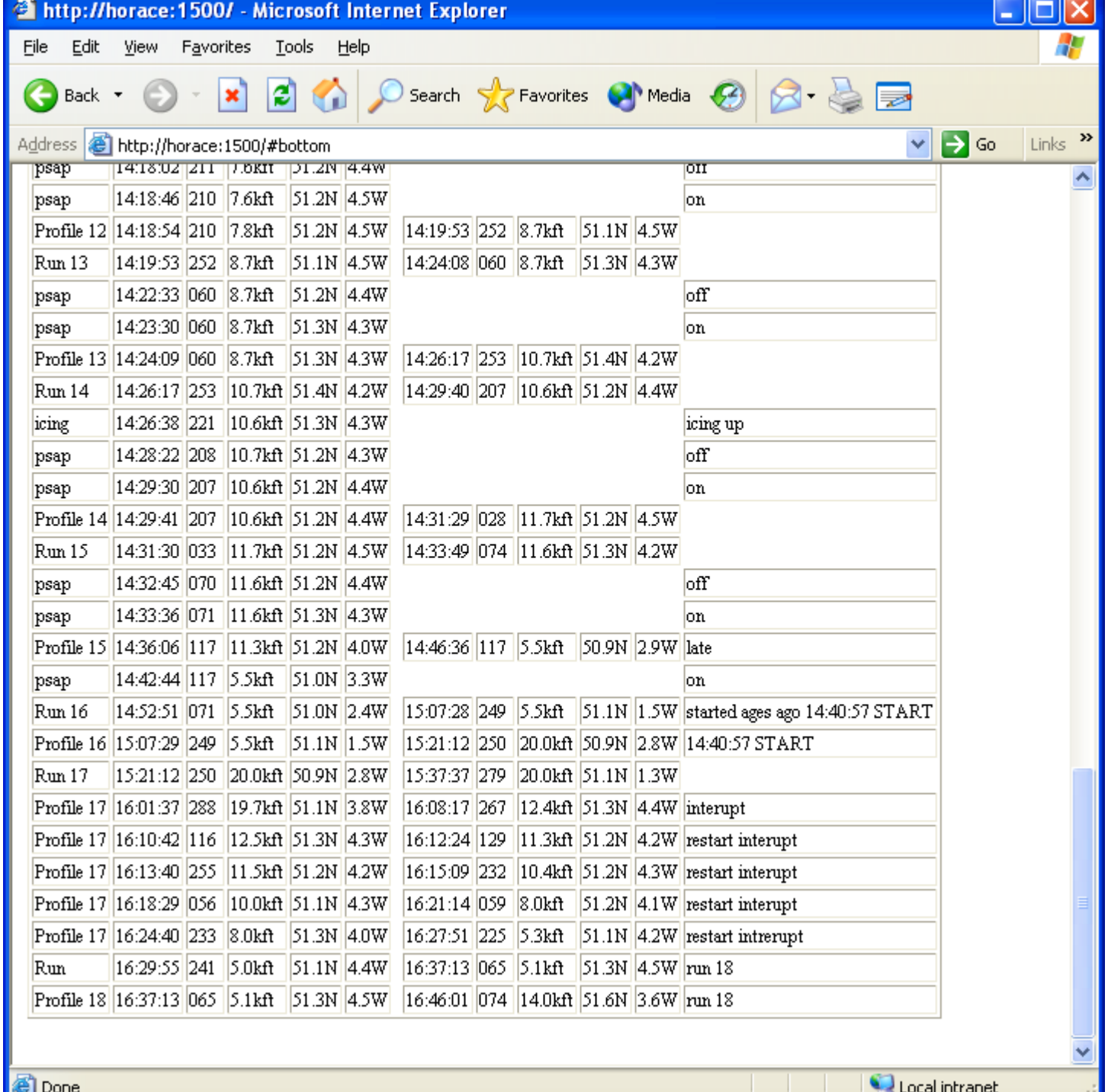


Flight Summary B423

Event	Start	Hdg	Hgt	Lat	Long	Stop	Hdg	Hgt	Lat	Long	Comment
Start-Up	11:47:21	126	1.00kft	52.1N	0.6W						
taxy	11:48:26	126	1.00kft	52.1N	0.6W						
ASP	11:49:10	053	0.99kft	52.1N	0.6W						Open
T/O	12:01:05	213	0.00kft	52.1N	0.6W						12:00:47
Video	12:29:23	250	18.0kft	51.8N	2.7W						started to record
PSAP	12:40:01	251	18.0kft	51.6N	3.9W						flow off
PSAP	12:40:29	251	18.0kft	51.6N	3.9W						flow on
PSAP	12:47:26	249	18.0kft	51.4N	4.6W						off
psap	12:49:28	250	18.0kft	51.4N	4.9W						on
Run 1	12:51:14	250	18.0kft	51.4N	5.0W	12:51:16	250	18.0kft	51.4N	5.0W	12:47:212 to 12:49:22 FL180
Profile 1	12:53:10	250	18.0kft	51.3N	5.2W	12:54:42	098	17.0kft	51.2N	5.3W	run 1 end as well
Run 2	12:54:43	098	17.0kft	51.2N	5.3W	13:02:25	111	16.9kft	51.5N	4.4W	
PSAP	12:58:07	069	17.0kft	51.4N	4.9W						off
psap	13:01:43	073	17.0kft	51.5N	4.5W						on
Profile 2	13:02:26	111	16.9kft	51.5N	4.4W	13:03:19	131	16.0kft	51.4N	4.3W	
Run 3	13:03:19	131	16.0kft	51.4N	4.3W	13:10:00	219	16.0kft	51.4N	4.7W	
psap	13:07:32	252	16.0kft	51.5N	4.5W						off
psap on	13:09:26	247	16.0kft	51.4N	4.7W						
Profile 3	13:10:00	219	16.0kft	51.4N	4.7W	13:12:33	025	14.0kft	51.4N	4.8W	
Run 4	13:12:34	025	14.0kft	51.4N	4.8W	13:17:26	135	14.0kft	51.5N	4.3W	
psap	13:14:21	061	14.0kft	51.5N	4.6W						off
psap	13:16:27	059	14.0kft	51.5N	4.4W						on
Profile 4	13:17:26	135	14.0kft	51.5N	4.3W	13:19:31	329	12.0kft	51.5N	4.2W	
Run 5	13:19:32	329	12.0kft	51.5N	4.2W	13:24:06	203	11.9kft	51.5N	4.6W	



psap	13:22:03	249	12.0kft	51.5N	4.4W						off
psap	13:23:27	241	12.0kft	51.5N	4.5W						on
Profile 5	13:24:07	203	11.9kft	51.5N	4.6W	13:27:03	066	10.0kft	51.5N	4.6W	13:26:32
Run	13:27:03	066	10.0kft	51.5N	4.6W	13:30:26	218	10.0kft	51.4N	4.4W	13:26:32 run 6
psap off	13:28:15	060	10.0kft	51.5N	4.5W						
psap on	13:29:03	105	10.0kft	51.5N	4.4W						
Profile 6	13:30:26	218	10.0kft	51.4N	4.4W	13:39:28	210	1.7kft	51.0N	4.8W	run 6
psap	13:35:19	217	5.4kft	51.2N	4.6W						off
psap	13:36:57	212	3.8kft	51.1N	4.7W						on
Run 7	13:39:29	210	1.7kft	51.0N	4.8W	13:46:11	032	1.7kft	51.3N	4.6W	
psap	13:44:49	032	1.6kft	51.2N	4.7W						off
psap	13:44:59	031	1.7kft	51.2N	4.7W						on
Profile 7	13:46:11	032	1.7kft	51.3N	4.6W	13:47:32	087	2.7kft	51.3N	4.5W	
Run 8	13:47:33	081	2.7kft	51.3N	4.5W	13:54:46	215	2.7kft	51.1N	4.7W	
psap	13:52:07	217	2.6kft	51.2N	4.6W						off
psap	13:52:30	216	2.6kft	51.2N	4.6W						on
nev	13:53:34	216	2.6kft	51.1N	4.7W						total water switched off
Profile 8	13:54:47	215	2.7kft	51.1N	4.7W	13:56:52	051	4.6kft	51.1N	4.8W	
Run 9	13:56:53	051	4.6kft	51.1N	4.8W	14:00:10	056	4.7kft	51.2N	4.5W	
psap	13:58:18	057	4.6kft	51.2N	4.6W						off
psap	14:00:03	055	4.6kft	51.2N	4.5W						on
Profile 9	14:00:10	056	4.7kft	51.2N	4.5W	14:01:29	066	5.7kft	51.2N	4.3W	
Run 10	14:01:29	066	5.7kft	51.2N	4.3W	14:06:57	236	5.7kft	51.2N	4.7W	
psap	14:03:59	227	5.7kft	51.3N	4.4W						off
psap	14:05:52	238	5.6kft	51.2N	4.6W						on
Profile 10	14:06:57	236	5.7kft	51.2N	4.7W	14:07:57	289	6.6kft	51.2N	4.7W	
Run 11	14:07:57	289	6.6kft	51.2N	4.7W	14:14:19	063	6.7kft	51.3N	4.3W	
psap	14:11:20	069	6.6kft	51.2N	4.6W						off



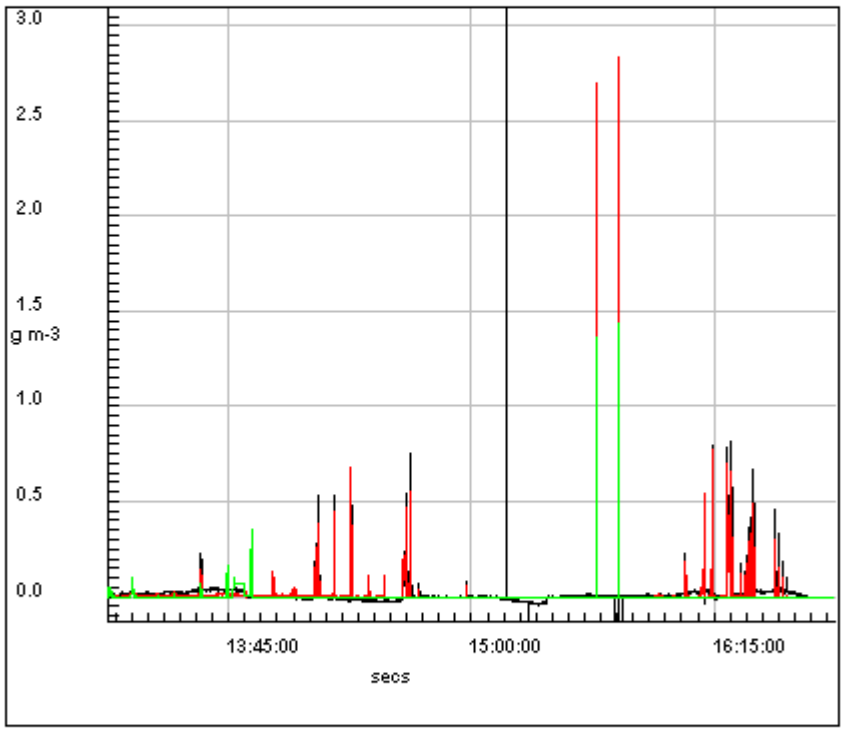
psap	14:18:02	211	7.6kft	51.2N	4.4W						off
psap	14:18:46	210	7.6kft	51.2N	4.5W						on
Profile 12	14:18:54	210	7.8kft	51.2N	4.5W	14:19:53	252	8.7kft	51.1N	4.5W	
Run 13	14:19:53	252	8.7kft	51.1N	4.5W	14:24:08	060	8.7kft	51.3N	4.3W	
psap	14:22:33	060	8.7kft	51.2N	4.4W						off
psap	14:23:30	060	8.7kft	51.3N	4.3W						on
Profile 13	14:24:09	060	8.7kft	51.3N	4.3W	14:26:17	253	10.7kft	51.4N	4.2W	
Run 14	14:26:17	253	10.7kft	51.4N	4.2W	14:29:40	207	10.6kft	51.2N	4.4W	
icing	14:26:38	221	10.6kft	51.3N	4.3W						icing up
psap	14:28:22	208	10.7kft	51.2N	4.3W						off
psap	14:29:30	207	10.6kft	51.2N	4.4W						on
Profile 14	14:29:41	207	10.6kft	51.2N	4.4W	14:31:29	028	11.7kft	51.2N	4.5W	
Run 15	14:31:30	033	11.7kft	51.2N	4.5W	14:33:49	074	11.6kft	51.3N	4.2W	
psap	14:32:45	070	11.6kft	51.2N	4.4W						off
psap	14:33:36	071	11.6kft	51.3N	4.3W						on
Profile 15	14:36:06	117	11.3kft	51.2N	4.0W	14:46:36	117	5.5kft	50.9N	2.9W	late
psap	14:42:44	117	5.5kft	51.0N	3.3W						on
Run 16	14:52:51	071	5.5kft	51.0N	2.4W	15:07:28	249	5.5kft	51.1N	1.5W	started ages ago 14:40:57 START
Profile 16	15:07:29	249	5.5kft	51.1N	1.5W	15:21:12	250	20.0kft	50.9N	2.8W	14:40:57 START
Run 17	15:21:12	250	20.0kft	50.9N	2.8W	15:37:37	279	20.0kft	51.1N	1.3W	
Profile 17	16:01:37	288	19.7kft	51.1N	3.8W	16:08:17	267	12.4kft	51.3N	4.4W	interupt
Profile 17	16:10:42	116	12.5kft	51.3N	4.3W	16:12:24	129	11.3kft	51.2N	4.2W	restart interupt
Profile 17	16:13:40	255	11.5kft	51.2N	4.2W	16:15:09	232	10.4kft	51.2N	4.3W	restart interupt
Profile 17	16:18:29	056	10.0kft	51.1N	4.3W	16:21:14	059	8.0kft	51.2N	4.1W	restart interupt
Profile 17	16:24:40	233	8.0kft	51.3N	4.0W	16:27:51	225	5.3kft	51.1N	4.2W	restart intrerupt
Run	16:29:55	241	5.0kft	51.1N	4.4W	16:37:13	065	5.1kft	51.3N	4.5W	run 18
Profile 18	16:37:13	065	5.1kft	51.3N	4.5W	16:46:01	074	14.0kft	51.6N	3.6W	run 18

http://horace/plot/plot.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

New plot, same times

Flight B423 16:51:42
Heading 71 deg Speed 267 knots Height 14.0kft Press 594mb
Lat 51°42.0'N Long 2°54.0'W Wind 7 ms-1/ 234 deg
Temp -24.24C Dewpoint -30.33C
From 13:00:00 to now



Current values

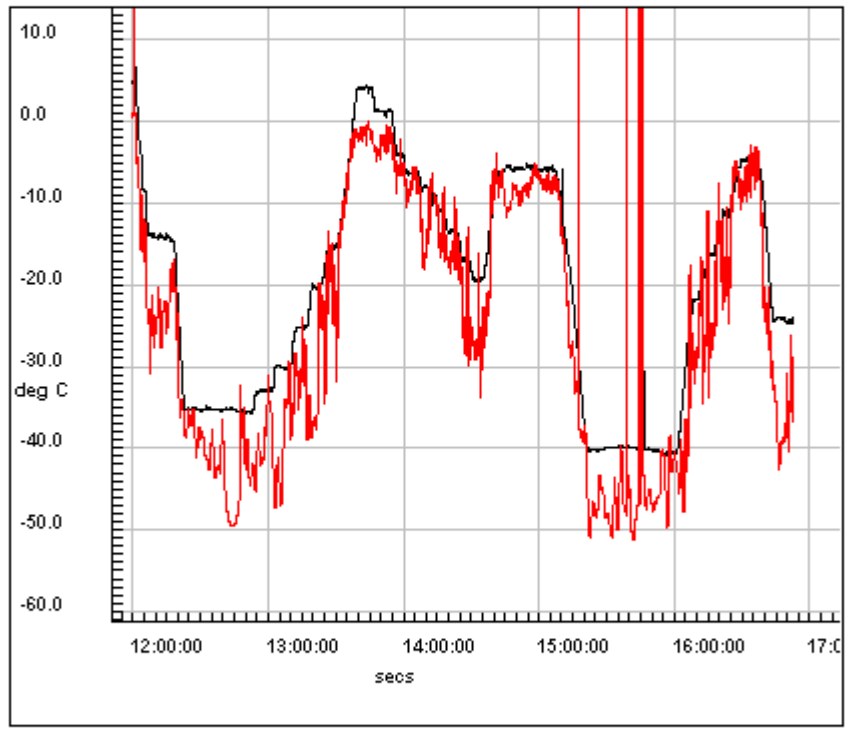
TIME FROM MIDNIGHT	60699	secs	All	sc
JW LIQUID WATER CONTENT	-0.01	g m-3		
NEVZOROV LIQUID WATER	0	g m-3		
NEVZOROV TOTAL WATER	0	g m-3		

http://horace/plot/plot.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

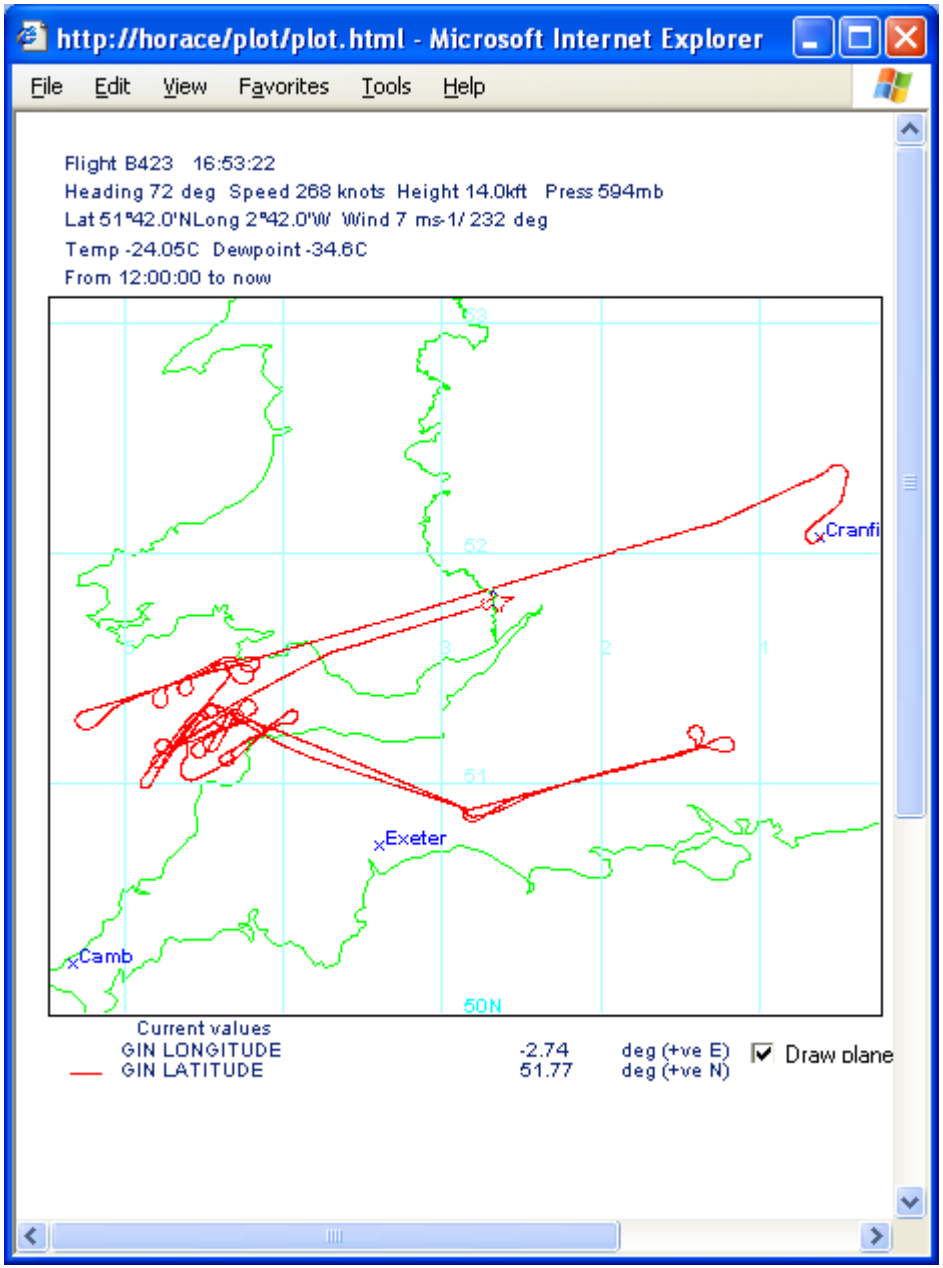
New plot, same times

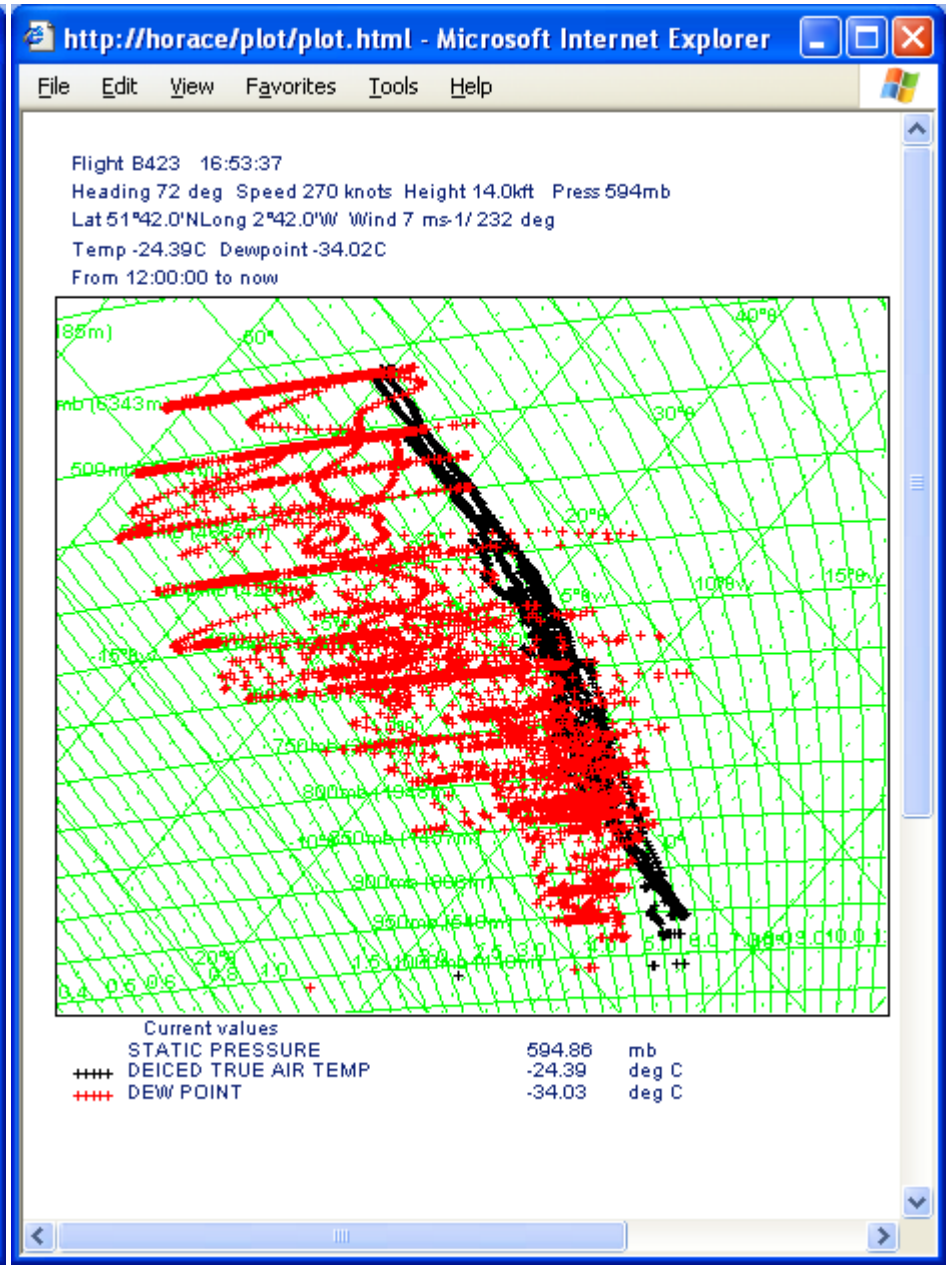
Flight B423 16:52:56
Heading 72 deg Speed 271 knots Height 14.0kft Press 594mb
Lat 51°42.0'N Long 2°42.0'W Wind 6 ms-1/ 231 deg
Temp -24.54C Dewpoint -36.72C
From 12:00:00 to now



Current values

TIME FROM MIDNIGHT	60774	secs	All	sc
DEICED TRUE AIR TEMP	-24.54	deg C		
DEW POINT	-36.73	deg C		


http://horace/plot/plot.html - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Flight B423 16:53:22
Heading 72 deg Speed 268 knots Height 14.0kft Press 594mb
Lat 51°42.0'N Long 2°42.0'W Wind 7 ms-1/ 232 deg
Temp -24.05C Dewpoint -34.6C
From 12:00:00 to now
Cranfi
Exeter
Camb
52
51
50N
Current values
GIN LONGITUDE -2.74 deg (+ve E)
GIN LATITUDE 51.77 deg (+ve N)
Draw plane

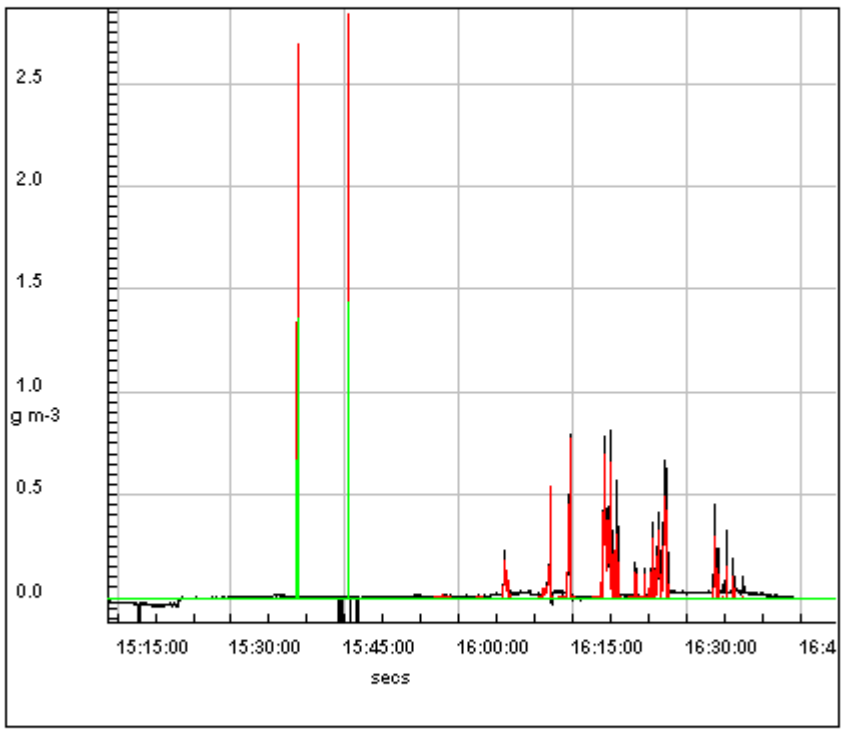

http://horace/plot/plot.html - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Flight B423 16:53:37
Heading 72 deg Speed 270 knots Height 14.0kft Press 594mb
Lat 51°42.0'N Long 2°42.0'W Wind 7 ms-1/ 232 deg
Temp -24.39C Dewpoint -34.02C
From 12:00:00 to now
Current values
STATIC PRESSURE 594.86 mb
DEICED TRUE AIR TEMP -24.39 deg C
DEW POINT -34.03 deg C

http://horace/plot/plot.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

New plot, same times

Flight B423 16:54:58
Heading 72 deg Speed 270 knots Height 14.0kft Press 595mb
Lat 51°48.0'N Long 2°30.0'W Wind 7 ms-1/ 232 deg
Temp -24.19C Dewpoint -40.2C
From 13:00:00 to now



Current values

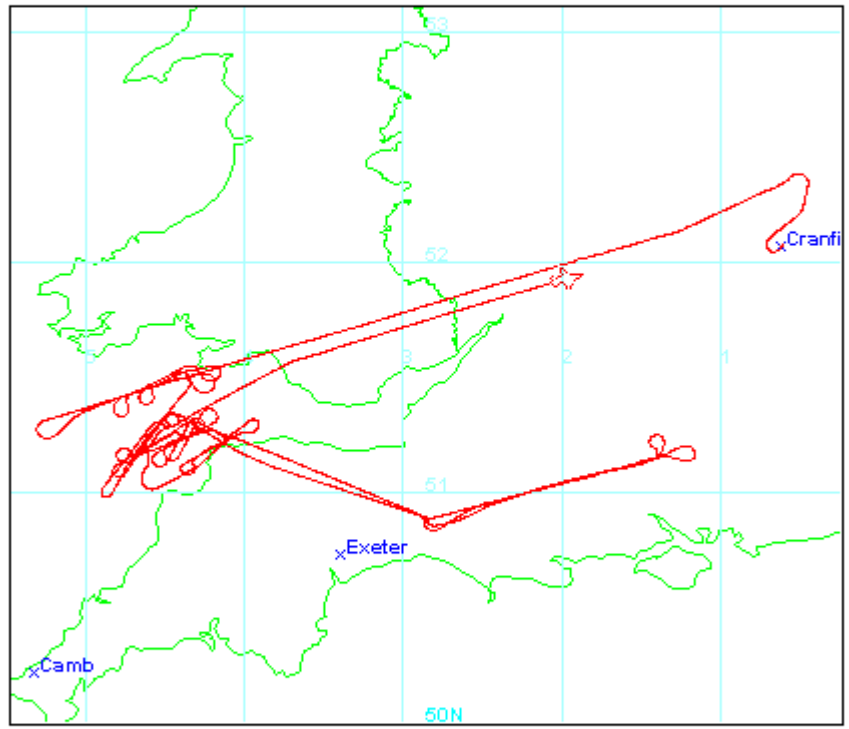
	TIME FROM MIDNIGHT	60897	secs
	JAW LIQUID WATER CONTENT	-0.01	g m-3
	NEVZOROV LIQUID WATER	0	g m-3
	NEVZOROV TOTAL WATER	0	g m-3

All sc

http://horace/plot/plot.html - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Flight B423 16:58:49
Heading 73 deg Speed 283 knots Height 11.6kft Press 652mb
Lat 51°54.0'N Long 2°0.0'W Wind 8 ms-1/ 228 deg
Temp -18.0C Dewpoint -34.04C
From 12:00:00 to now



Current values

	GIN LONGITUDE	-2.06	deg (+ve E)
	GIN LATITUDE	51.91	deg (+ve N)

Draw plane

Mission Scientist's Log [APPRAISE-CLOUDS] B2

Flight No B423 **Date** 20/01/09 **Name** K.N Bower **Page** 1 **of** 9

Time (GMT)	Run / Profile	Height	Hdg	GPS Position	Remarks / Observations (cloud type & amount in oktas, weather, visibility, winds, sea state etc.) eg Cirrus 2/8, StratoCu 3/8, hazy, wind 240°/24kts
11: 44.50	(ICNB)	-11:47:05			Engine Starts 4–1
11:48:59	(KNB)				Taxi (QNH 959 mb) (210/12 kts)
12:00.57	( )				Rolling
12:01.26	( )				T/O
					Bright-sunny – broken clouds – some Ci/ strat tus high up.
12:09:20	≡ 12:10:00 (#405 KNB)				* TIME CHECK *
					PCASP – Nothing since BL. at 2008"
					CAS agrees.
12:19:56	Transit	FL100	241	52°12'/0°48'	696mb -14.03°C/-23.88°C 12m/s/229°
					Cloud above us to RHS ~ + 2000'
					(Seeing some noise on 2DP) ice adds than ~ -15°C
					CPI small amount of noise on CAPS CIP
					(up to about 0.1 cm^{-3})
12.19....					Passing through some Ci shortly on this climb
					from FL100 – FL180
12:25 49	Transit	FL180			large ice ppk out; mixed habit
					2DC – sees it too
					2DP – not sure....
					CP1/2DS 200μm
12:45:					Full turret ahead – + cont – will work it
					at FL180 – obt -35°C
12:47.22	SLR1 →CLOUD TURRET	FL180	249	51°24'/4°36'	2000μm agg with 2DC [Into Turret]
					but small still "CIT"
					[505 mb, -35.62°/-45.94°C 13m/s/225]

Mission Scientist's Log

Flight No B.423 **Date** 20/01/09 **Name** K.N. Bower **Page** 2 **of** 9

Time (GMT)	Run / Profile	Height	Hdg	GPS Position	Remarks / Observations (cloud type & amount in oktas, weather, visibility, winds, sea state etc.) eg Cirrus 2/8, StratoCu 3/8, hazy, wind 240°/24kts
12:49.22	SLR 1 [out of cloud]	FL180	250	51°18'/4°48'	Out of dark band [505mb -35.62/-35.84°C 12m/s/225°]
12.53.07	R1e/P1s	FL160	250	51°18'/5°12'	New clear air section -35.83/-42.07° 11m/s/251° 250mb
12 54.37	P1e/R2s	FL170	110	51°12'/5°12'	[-33.21/-45.14°C, 526mb, 7m/s/226]
12:57.59	R2	FL170			2DS } seems ppt out of cloud 2DC } was peaking at 75μm
					2DP — seems to not work.
					2DC seems to be 200-300μm Xtals.
12.59.34	R2	FL170	69°	51°24'/4°42'	into cloud again [-32.83/-36.76° 526mb 8m/s/239]
13.01.38	R2	FL170	73°	51°24'/4°24'	out of cloud [-33.1/-35.99°, 526, 9/242°]
13:02.08	R2				turning (-33.1/-35.99°C)
13:02:26	R2end/P2	FL170	111	51°24'/4°18'	[-32.5 /-43.02 529mb 9m/s/240°]
13:03:17	P2end/R3	FL160	137	51°24'/4°18'	[-29.99/-47.3°C 549mb 9m/s/235°]
					Cu cloud — 2DP not working — reboot with PIP?
13.07.24	R3	FL160	252	51°24'/4°24'	into cloud [-30.16/-35.15° 549mb 13m/s/225°]
					agg plates-needles, water ?? (at -30°??)
					out of cloud - around TWC to / pass (less than last pass)
13.09.59	R3end/P3	FL160	225	51°24'/4°42'	and turning. (-30.26/-36.64 549mb 12m/s/231°)
13.11.18	P3	4.7kft	239	51°18'/4°42'	[577mb -28.82/-35.54°C 10m/s/227°]
13.12.32	P3end/R4	FL140	21	51°18'/4°48'	[-25.41/-31.09°, 594mb, 9m/s/261°]
					Cloud maturing now
13:14.53	R4	FL140	81	51°24'/4°30'	Into cloud again [-25.32/-30.43° 594mb 9/260]
13.16.23	R4	FL140	59	51°30'/4°24'	leave cloud [-25.12/-26.90°, 594mb, 9/248]
13.17.24	R4end/P4	FL140	135	51°30'/4°18'	[-24.94/-38.83°C 594mb 9m/s/247°]

Mission Scientist's Log

Flight No B423 **Date** 20/01/09 **Name** KN Bower **Page** 3 **of** 9

Time (GMT)	Run / Profile	Height	Hdg	GPS Position	Remarks / Observations (cloud type & amount in oktas, weather, visibility, winds, sea state etc.) eg Cirrus 2/8, StratoCu 3/8, hazy, wind 240°/24kts
13.19.29	P6end/P5	FL120	336	51°30'/4°6'	[-19.93°C/-38.6 643mb 10m/s/265°]
					Updraughts in cloud 1.5m/s cf. outside cloud.
13:24:04	P5end/P5	FL120	205	51°24'/4°30	[-19.82°/-25.0°C 646mb 9m/s/233°]
					No CCN here
13:26:25	P5end/P6st	FL100	37	51°24'/4°36	Very little cloud left now
					[-15.52°/-23.1°C 695mb 9m/s/257°]
					AMS }
					CCN } Zero readings
					PCASP } cloud dissipated too.
13.30.26	P6end/P6	FL100	218	51°24'/4°18'	↓1000ft (final) -15.32°/-31.63° 696mb 10°/239°
					going SW to pt 37 - will let be small
					scale convection - run through clouds on
					legs until pop up through CT's - then look
					for decent growing turned ....
13:34:55	P6	5.7kft	217	51°12'/4°36	[-7.0°/-8.12°C 818mb 11m/s/235°]
					PCASP 10 cm^{-3}
					CAS 2-5 cm^{-3}
13:35.55	P6	FL460	217	51°6'/4°36'	Cloud [-4.56°/-5.95°C 849mb 10m/s/245]
13.36.57	P6	FL37	212	51°6'/4°42'	Ow'd cloud [-1.98°C/-4.24° 882mb 10m/s/254°]
					Liquid
					AMS->
					CCN - (0.2%) 5-6 cm^{-3}
					PCASP - 10 cm^{-3}
13.39.24	P6end/P7	1.6kft	210	51°0/4°48'	1000ft (990mb) [3.95°/-1.45°C 953mb 10m/s/250°] will return under a little developing cloud.

Mission Scientist's Log

Flight No B.423 Date 20/01/09 Name K.N. BOWER Page 4 of 9

Time (GMT)	Run / Profile	Height	Hdg	GPS Position	Remarks / Observations (cloud type & amount in oktas, weather, visibility, winds, sea state etc.) eg Cirrus 2/8, StratoCu 3/8, hazy, wind 240°/24kts
					Small cloud ahead – precipitating below – will
					fly under (Forming over Lundy Island?)
					2DP – notice up with the ppt (wet)
13:46:07	R7and/P7	1.6kft	32	51°12'/4°30'	[1000ft] run [4.06°/-1.33°C 954mb 10m/s/282°]
13.47.31	P7and/P8	2.6kft	87	51°12'/4°24'	[2000ft] still below cloud – Filter on nav.
					PCASP = 10 cm^{-3}
					CAS = ~8 cm^{-3} + deformed rain / Xtals ??
					CPI – definitely ice
					[1.35°/-3.33°C 919mb 11m/s/272]
					Total Water on the Nev – Lost rave
13.54.42	P8and/P6	2.6kft	215	51°0'/4°42'	2000 → 4000ft in P8 [1.37°/-1.55°C 920mb
					10m/s/252°]
13 56.03	P6and/R9	4.6kft	51	51°6'/4°42'	[4000ft run] [955mb -3.8°C/-5.83° 7m/s/275°]
13.57.07	R9	4.6kft	"	51°6/4°42	Bumpy !
13.58.35	R9	4.6kft	56	51°6'/4°36	[Cloud !] [-4.19°/-4.12°C 85tmb 8m/s/256°]
					CPI – mostly liquid + rimed aggregate.
13.59.26	R9	4.6kft	56	51°12'/4°30'	[Out of Cloud] [-4.04°/-6.14°C 854mb 9m/s/272°]
14.00.06	R9and/P9	4.6kft	55	51°12'/4°24'	[-4.14°C/-5.18°C 85tmb 11m/s/268°]
14.01.28	R9/R10	5.6kft	86	51°12'/4°18'	5000ft [-6.38°C/-7.09° 822mb 10m/s/252°]
					SMPS sees all CAS – 2 cm^{-3}
					PCASP <10
					CCN' >60 cm^{-3} (0.2%)
14:04.17	R10	5.6kft	230	51°12'/4°24	Cloud – mostly ice with little liquid.
					[-6.6°/-6.58°C 822mb 12m/s/245°]
14.05 44	R10	5.6kft	223	51°12'/4°30	Clear of Cloud [-6.79°/-5.71 822 12/234°]

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Flight No B423 **Date** 20/01/09 **Name** K.N. Bower **Page** 5 **of** 9

Time (GMT)	Run / Profile	Height	Hdg	GPS Position	Remarks / Observations (cloud type & amount in oktas, weather, visibility, winds, sea state etc.) eg Cirrus 2/8, StratoCu 3/8, hazy, wind 240°/24kts
14:06:49	R10end/P10	5.6kft	235	51°6'/4°36'	5000 ft [-6.34°/-7.74°C 882mb 9/246°]
14:07:57	P10end/R11	6.6kft	289	51°6'/4°42'	6000ft [-8.29°/-11.67°C 792mb 9/245°]
14:11.16	R11	6.6 kft	89	51°6'/4°30'	Little cloud (haze)
14:12.13	R11	6.6kft	68	51°12'/4°30	Bumps main cloud nav. [-8.25°/-9.34°]
14.13.20	R11	6.6	89	51°12'/4°18'	Out of cloud - v. bumpy at end + ppt-heavy.
14.14.18.	R11end/P11st	6.6kft	63	51°12'/4°12'	6000ft [-9.09°/-9.32°C 792mb 8m/s/251°]
14.15.49	P11end/R12st	7.6kft	260	51°18'/4°18'	7000ft [-10.66/-15.19°C 762mb 10m/s/239°]
14.17.58	R12	7.6kft	211	51°12'/4°24'	Cloud [-12.16°/-8.15°C 763mb 11/245°]
					Cloud -
					Mixed phase - ice falling out of cloud
					each side - tipped up middle
14.18.42	R12end/P12stn	7.6	210	51°6'/4°24'	[-11.93°/-16.24°C 763mb 7m/s/242°]
14.19.52	P12end/R13	8.6kft	252	51°6'/4°30'	8000ft [-13.65°/-17.3° 733mb 10m/s/232°]
14.22.39	R13	8.6kft	59	51°12'/4°24'	Cloud edge - filled by ppt [-13.29°/-13.94°]
14.23.16	R13	8.6kft	60	51°12'/4°18'	Out of cloud [-13.82°/-11.92°C 733mb 8m/s/251]
					Turb - mod
14.24.07	R13end/P13st	8.7kft	60	51°12'/4°12'	[732mb -13.82/-15.0 6m/s/247]
	P13end/R14				
14.26.10	P13end/R14	10.6kft	264	51°18'/4°12'	[10,000ft] [-16.92°/-21.26°C 679mb 9m/s/249]
14.28.11	R14	10.6 kft	208	51°12'/4°18'	Cloud [-17.2°/-21.23°C 679mb 8m/s/234] bumps
14.29.00	R14	10.6 kft	207	51°12'/4°18'	Out of cloud [-16.9/-27.01 679 9/226]
14.29.36	R14end/P14st	10.6kft	207	51°6'/4°24'	[-17.16°/-24.56° 679mb 10m/s/230°]
14.31.27	P14end/R15	11.6kft	28	51°6'/4°24'	11000ft [-19.61°/-27.78° 652mb 7m/s/230°]
14.33.11	R15	11.6kft	71	51°12'/4°18'	In/Out cloud [-19.16°/-23.06° 655mb 8/239°]
14.33.50	R15end	11.6kft	74	51°12'/4°12'	[-19.45°/-25.26°C 655mb 6/236°]

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Flight No B. 423 **Date** 20/01/09 **Name** K.N. Bowen **Page** 6 **of** 9

Time (GMT)	Run / Profile	Height	Hdg	GPS Position	Remarks / Observations (cloud type & amount in oktas, weather, visibility, winds, sea state etc.) eg Cirrus 2/8, StratoCu 3/8, hazy, wind 240°/24kts
14.35.41	P15 climb	11.6Kft	115	51°12'/4°0'	11000ft [-19.09/-25.56 653, 6/237]
14.39.01	P15	7.9 Kft	117	51°6'/3.36	Ice detected [-11.7/-8.28°C 754mb 11/287]
		↓			(anti icing)
		6.2Kft			
14.40.21	P15	6.1Kft	116	51°0'/3°30'	CB [808mb -8.4°/-7.98° 6mb/253°]
14.40.52	Run16 start	5.5Kft	117	51°0'/3°24'	R15 → Chalkbeam - through corridor
					[-6.7°/ -5.53°C 826mb 7mb/241]
					AMS seeing little still
					Nosph < 5 Mm
14.50.30					RADSENSEM - contact
					reports :-
					Ci - 5-7 km (≡ 16400-2300 Ft) 4 13
					well aircraft at 5.5Kft FL55 - (4500 Ft)
14.55.00					(Cloud over Chalkbeam - 40 mins ago
					TWC error !! - go and measure it!)
14					
15.01.50	R16	5.5Kft	71	51°6'/1°24'	Ordered Chalkbeam. [826mb -5.8/-8.1°C
					(Alter alt and reached area) 7mb/237°]
15.06.43	R16?	5.5Kft	243	51°6'/1°24'	Ordered Chalkbeam outbound [-5.08°/-7.2°C]
15.07.19	R16end/P16	5.5Kft	249	51°6'/1°24'	[-5.71°/-8.15°C 826mb 10mb/249°]
15.09.43	P16	7.6Kft	256	51°0'/1°42'	Cloud out to Left (South) of us over S. coast

Mission Scientist's Log

Flight No B.423 Date 20/01/09 Name K.N. Bower Page 7 of 9

Time (GMT)	Run / Profile	Height	Hdg	GPS Position	Remarks / Observations (cloud type & amount in oktas, weather, visibility, winds, sea state etc.) eg Cirrus 2/8, StratoCu 3/8, hazy, wind 240°/24kts
15.21.09	P16end/R17start	FL200	250	50°48'/2°48'	[465mb -40.24°/-42.17°C Kms/218°]
15.22.51	R17-SLR	FL200	59	50°48'/2°42'	Ci head b Cloudbottom - little here
					20 km b West ends - stuff south too
15.33.33	R17	FL200	76	51°6'/1°24'	Orchard Cloudbottom again [-39.89/-43.52 465mb 12m/s/244]
					CPI 4 particles only
					CCN 3 per litre
					More ice on turn - Ci advecting E
					Eastwards.
15.52.18	R17 turning	FL200	254	50°48'/2°48'	- heading into more Ci (anvil outflow) [-40.29°]
					probing stellar + cellulars! 465mb
15.56.57	R17	FL200	287	50°54'/3°18'	cut of cloud - but will enter another anvil within soon.
15.58.02	R17	FL200	288	51°0'/3°24'	Into more Ci - anvil outflow here.
					[465mb -40.66/-38.55°C 465mb 8m/s/229°]
16.01.18	R17end/P17	FL200	288	51°6'/3°42'	Starting P down b probe through aged
					towers & huge anvil b South
16.05.54	P17	15kft	301	51°12'/4°12'	Cloud [570mb -27.16/-41.9°C 7m/s/250°]
					W = 5m/s
~~16.05.54~~					Out of cloud (screen dump missed)
16.08.34	P17 mk	12.4kft	260	51°12' 4°24'	int for turn (will move across below rec P17)
~~16.~~					[-22.06°/-30.8°C 633mb 10ms/231]
16.10.40	P17 rec	12.5kft	116	51°18'/4°18'	~~H40017~~ [631mb -21.74/-27.9°C 7m/s/243]
	(CLOUD)				Not so much (1000 cm³ 2DC)
					Calc TWC 10g/cm³ - some big ice (CPI) 16

(2DC - more near cloud edge than W edge)

Mission Scientist's Log

Flight No B423 **Date** 20/01/09 **Name** K.N. Bower **Page** 8 **of** 9

Time (GMT)	Run / Profile	Height	Hdg	GPS Position	Remarks / Observations (cloud type & amount in oktas, weather, visibility, winds, sea state etc.) eg Cirrus 2/8, StratoCu 3/8, hazy, wind 240°/24kts
~~16.10.40~~					Cloud
16.12.18	P17	11.4kft	129	51°12'/4°6'	No Cloud [659mb −19.05/−20.7c 7m/s/262°]
16.12.25	P17/int	11.3kft	129	51°12'/4°6'	Int [661mb −18.67°/−25.04°C 7m/s/265]
16.13.40	P17/rec	11.5kft	255	51°12'/4°6'	[656mb −18.83°/−30.58°C 11m/s/230°]
16.14.59	P17 int	10.5kft	232	51°6'/4°12'	Int - just out of cloud - lot of ppt (heard in the edge of that cloud)
16:18.28	P17 rec	10.0kft	56	51°6'/4°18'	[695mb −15.49°/−23.34°C 9m/s/257]
16.18.52	P17	9.7kft	57	51°6'/4°12'	Cloud [702mb −15.17°/−24.67° 7m/s/260]
					Icing on pylon - port (LHS)
					Starboard - Lots of ice too
					- had few gen's - almost all LW.
16.19.32	P17	9.4kft	57	51°6'/4°12'	huge amount (cloud) ppt [712mb −14.35/−7.56° 8/303°]
16.20.25	P17	8.6kft	58	51°12'/4°6'	Out of main cloud - into shoulder - feeding it.
16.21.07	P17	8.0kft	59	51°12'/4°	Out of cloud now [749mb −11.56°/−12.52 22m/s/3 9°]
16.21.14	P17 int	7.9kft	59	51°12/4°	−11.4°/−12.59° 752mb 25m/s/324°
16.24.38	P17 rec	7.9kft	232	51°12'/4°	→ cloud [−11.02°/−19.36° 758mb 27m/s/175°]
16.25.30	P17	7.3kft	228	51°12'/4°	[772mb] Still in shoulder [−9.99°/−9.27° 35m/s/170°]
					mixed phase - larger ice
16.26.29	P17	6.5kft	224	51°12'/4°6'	pylons 4mm ice on both sides
16.27.47	P17 int	5.4kft	220	51°6'/4°12'	→ [795mb −8.25°/−6.80°C 17m/s/170°]
16.29.20	P17 rec	5.3kft	241	51°0'/4°18'	Heading to part 44 (990mb setting) [−5.35°/−8.84° 832mb 8m/s/262°]
16.29.51	P17 end/ 2kft start	5kft	241	51°0'/4°24'	(990mb setting) [841mb −4.58°C/−7.57° 8m/s/261]
16.33.26	R18	5kft	13	51°0'/4°36'	Cloud in small line [−4.57/−4.99 841mb 8/277]
16.36.02	R18	5kft	29	51°12'/4°30'	Cloud [−4.39/−6.51 841mb 8/256]

CPI - mainly LW

Heading towards line small Cu - will run along it on way to recover to aerials home.

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16.37.13	RIBand/ P18	5.0 hft	65	51°12'4'24'	[-4.74°/-3.52° 841mb 8m/s/253]
					[Core Cards - Columns (CF) and beyond
					dumps - mainly beyond (from earlier)]
					[20/05 992 QNH.] CRANFIELD
17.23 hb.					Landed.

CVI log

1/20/09	10:29:11 AM	
1/20/09	10:29:31 AM	CPI 1.0 lpm ON
1/20/09	11:32:54 AM	Lyman zero pre take off
1/20/09	12:06:38 PM	Lyman zero post take off
1/20/09	12:06:49 PM	Laser light off on CPC
1/20/09	12:09:01 PM	Aerosol mode
1/20/09	12:09:26 PM	
1/20/09	12:18:53 PM	Tip heater up to 55 to avoid icing of last flight.
1/20/09	12:45:44 PM	Tip to 60, icing expected
1/20/09	12:47:50 PM	CVI mode
1/20/09	12:48:46 PM	CVI mode
1/20/09	12:49:47 PM	CVI mode
1/20/09	12:51:39 PM	CVI mode
1/20/09	12:53:15 PM	Aerosol mode
1/20/09	12:58:22 PM	Some precipitation from anvil
1/20/09	12:59:39 PM	CVI mode, no warning
1/20/09	1:01:03 PM	0.1 liquid water from JW Nevs
1/20/09	1:01:46 PM	CF of 1.5 giveds reasonable LW agreement
1/20/09	1:01:56 PM	Aerosol mode
1/20/09	1:03:10 PM	Some precip from anvil
1/20/09	1:04:36 PM	Very clean air!! almost zero aerosol
1/20/09	1:07:19 PM	CVI mode
1/20/09	1:10:20 PM	Aerosol mode
1/20/09	1:11:03 PM	CVI mode
1/20/09	1:11:22 PM	CVI mode
1/20/09	1:11:48 PM	may stay in CVI mode as difficult to get in cloud warnings
1/20/09	1:14:27 PM	
1/20/09	1:17:05 PM	CVI water seems much higher than JW & Nevs?? CVI 0.6 peak against 0.05?? in cloud.
1/20/09	1:23:12 PM	AMS was NOT on AMS last two runs
1/20/09	1:24:21 PM	AMS was on for last run.
1/20/09	1:35:24 PM	Aerosol mode
1/20/09	1:36:01 PM	cloud, small bit
1/20/09	1:38:43 PM	Low level aerosol mode
1/20/09	1:40:27 PM	CVI mode briefly, back to aerosol for below cloud run
1/20/09	1:42:08 PM	Precipitation spotted from flight deck
1/20/09	1:44:00 PM	Precip spotted again
1/20/09	1:44:39 PM	Precip
1/20/09	1:46:13 PM	CVI mode, heading in to cloud base
1/20/09	1:50:05 PM	Not much sgn of cloud base, too low. Stay in CVI mode
1/20/09	1:50:36 PM	AMS to zero to check aerosol in CVI mode
1/20/09	1:51:08 PM	AMS to zero to check aerosol in CVI mode
1/20/09	1:51:50 PM	Some precip about
1/20/09	1:52:04 PM	cloud
1/20/09	1:53:41 PM	cloud
1/20/09	1:53:59 PM	CF to 2.5 to check for zero
1/20/09	1:55:06 PM	CF back to 1.5 ready for acent to cloud
1/20/09	1:55:32 PM	Smell of butanol!
1/20/09	1:58:43 PM	AMS not on CVI
1/20/09	2:04:23 PM	cloud
1/20/09	2:05:18 PM	AMS not CVI
1/20/09	2:06:52 PM	Water content agreeing better, I think when we are overreading, AMS is being included in flow when it wasn't actualy using CVI.
1/20/09	2:11:13 PM	cloud
1/20/09	2:14:26 PM	Small amount of icing on tip
1/20/09	2:17:22 PM	cloud
1/20/09	2:21:54 PM	Liquid water taking its time to come down after cloud run in clear air, still in CF mode
1/20/09	2:22:33 PM	This maybe CF back ground as drierite gets old.
1/20/09	2:22:42 PM	cloud
1/20/09	2:27:00 PM	1-2 mm thick frosting on tip (60 degrees) flows ok
1/20/09	2:29:50 PM	Icing on tip 3-4 mm thick, still have flow
1/20/09	2:30:20 PM	tip heater to 70 degrees
1/20/09	2:31:08 PM	clouds seem to be mostly ice, very little liquid water.
1/20/09	2:38:59 PM	cloud
1/20/09	2:41:52 PM	In cloud, no ice, so Inlet must be iced and blocked, smell butanol

1/20/09	2:43:09 PM	Counts back again, aerosol mode, inlet cleared
1/20/09	2:44:10 PM	CVI mode, patchy cloud
1/20/09	2:46:52 PM	No CF pressure, no CF!
1/20/09	2:47:15 PM	Aerosol ode only. Strapped in so cant see tip.
1/20/09	2:47:48 PM	CF valve closed
1/20/09	2:54:17 PM	vac pump off, many butanol smells
1/20/09	2:54:30 PM	
1/20/09	2:55:31 PM	No more CVI
1/20/09	2:56:09 PM	PCASP still seeing stuff.
1/20/09	3:02:59 PM	vac pump back on
1/20/09	3:09:14 PM	Tip hole blocked with ice visualy, but some aerosol still being seen. vac pump back off
1/20/09	3:09:42 PM	Tip hole blocked with ice visualy, but some aerosol still being seen. vac pump back off.
1/20/09	3:15:09 PM	Ice on tip gone, visualy, vac pump back on
1/20/09	3:16:01 PM	Too high for aerosol now though.
1/20/09	3:17:30 PM	Fuse blown on vac pump power supply. Possibilty got to hot with no flow due to tip icing.
1/20/09	4:39:00 PM	vac pump off, loads of ice. EOS for CVI

Flight: B423

KEY

- Not Fitted
- Fitted, Not Operated
- Duff Data
- Minor Problem
- OK

Thermometers
- Cabin Temperature:
- Heimann:
- Deiced Temp:
- Non-deiced Temp:

Hygrometers
- FWVS:
- Buck CR2:
- General Eastern:
- Johnson Williams:
- Nevzorov:
- Total Water Probe:

Cameras
- Downward Facing:
- Forward Facing:
- Rearward Facing:
- Upward Facing:

Navigation + Aircraft
- Cruciform GPS:
- GIN Applanix:
- INU Honeywell:
- Radar Altimeter:
- RVSM IAS:
- RVSM Static Pressure:
- XR5 GPS:

Misc Core
- HORACE:
- AMTG:
- AVAPS:
- Cabin Pressure:
- Printer:
- S9 Static Pressure:
- Satcom C:
- Satcom H (VIRC):
- Turb Centre-Static:
- Turb Left Right:
- Turb Up-Down:
- Turb Horizontal Chk:
- Turb Vertical Chk:
- Weather Radar:

DLUs:
- DLU AERACK:
- DLU BBR Lower:
- DLU BBR Upper:
- DLU Core Chem:
- DLU Core Consoles:
- DLU Port Aft:
- DLU Port Fwd:
- DLU Stbd Fwd:

Radiometers
Lower:
- BBR (clear) Lower:
- BBR (IR) Lower:
- BBR (red) Lower:

Upper:
- BBR (clear) Upper:
- BBR (IR) Upper:
- BBR (red) Upper:

- ARIES:
- DEIMOS:
- IR Camera:
- JNO2 Lower:
- JNO2 Upper:
- JO1D Lower:
- JO1D Upper:
- MARSS:
- SHIMS Lower:
- SHIMS Upper:
- SWS:
- TAFTS:

Cloud Probes
- 2DC:
- 2DP:
- FFSSP:
- PCASP:
- PCASP SPP-200:
- 2DS:
- ADA:
- CAPS:
- CCN:
- CDP (fuselage):
- CDP (Canister):
- CIP 100 (PIP):
- CIP 25 (CIP):
- CPI:
- CVI (Inlet):
- CVI PCASP-X:
- CVI Ly-A Hygro
- FSSP (UMan):
- SID1:
- SID2:
- SID3:

Aerosol
- CPC 3025A:
- CPC 3786 H2O:
- Filters 47mm:
- Filters 90mm:
- Neph - Dry:
- Neph - Wet:
- PSAP:
- AMS:
- CPC (AMS):
- SMPS (AMS):
- CPC 3010A (CVI):
- INC:
- Mini-LIDAR:
- SP2:
- UHSAS:
- VACC:

Chemistry
- CO Aerolaser 5002:
- NOx TE42C:
- Ozone TE49C:
- Ozone TE49:
- SO2 TE43C:
- TDLAS (NIR) CH4:
- TDLAS (NIR) CO2:
- FAGE:
- Formaldehyde:
- NOx FAAM:
- NOxy:
- ORAC:
- PAN:
- PERCA:
- Peroxide:
- PTRMS:
- TDLAS (1C):
- WAS Bags:
- WAS Bottles:

Misc Non-Core
- CASI/ATM:
- LIDAR (big):
- LTI:
- SAW Hygrometer:

Report Created 15/09/2009 14:25:58

Last Updated: 21/01/2009 10:40:13